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AEROSPACE MEDICINE AND BIOLOGY

AN ANNOTATED BIBLIOGRAPHY

VOLUME XI

1962-1963 LITERATURE

Project Supervisor:
Arnold J. Jacobius

Bibliographers:
Leroy D. Davis
Kristallo V. Pappajohn
Paul E. Spiegler
Ilga M. Terauds
Elaine S. Valliere

Editor:
Roman Kenk

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INTRODUCTION

The material presented in this publication constitutes Volume XI of Aerospace Medicine and Biology: An Annotated Bibliography. It was compiled by the Aerospace Medicine and Biology Bibliography Project (Library of Congress) under contract to the National Aeronautics and Space Administration. Volume XI contains a selection of journal articles and other pertinent references that were published during the years 1962 and 1963. Although this compilation cannot be described as exhaustive, it is sufficient to provide, without undue delay, access to the most important contributions that appeared in the literature during this period.

Volume XI represents the continuation of a project which began more than ten years ago. Following is a listing of previous volumes together with availability information:

Vol. I (1952): Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, as PB 121 543, at $4.00 a copy.

Vol. II (1953): Aerospace Medical Association, Washington National Airport, Washington, D.C. 20001, at $5.00 a copy, postpaid in the United States and Canada.

Vol. III (1954): Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, as PB 171 029, at $6.00 a copy.

Vol. IV (1955): Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, as AD 258 191, at $5.00 a copy.

Vol. V (1956): Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, as AD 274 064, at $5.00 a copy.

Vol. VI (1957): Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, as AD 402 638, at $5.00 a copy.

The contents of Volume XI are arranged in a manner similar to that employed in the preparation of Volume VI. Subject scope and the format of references, abstracts, and indexes have also remained the same. Journal articles that have appeared in such journals as Aerospace Medicine and were subsequently abstracted and announced in International Aerospace Abstracts have been omitted from this publication. Additional volumes in preparation will contain compilations of pertinent references that appeared during the period 1958 - 1961 (Volumes VII - X). Upon completion of the latter volumes, a user will have convenient access to the literature on this subject for the entire period from 1952 through 1963.

In order to continue this work and accelerate the distribution of information on this subject, the National Aeronautics and Space Administration, in July 1964, began publication of Aerospace Medicine and Biology: A Continuing Bibliography. This annotated abstract-index journal serves as a single announcement medium for all pertinent material of the kind that was formerly announced by NASA in Scientific and Technical Aerospace Reports (STAR), by the American Institute of Aeronautics and Astronautics in International Aerospace Abstracts (IAA) and by the Library of Congress project in a section titled "Abstracts of Current Literature," which is included in the journal Aerospace Medicine (formerly known as the Journal of Aviation Medicine). The new bibliography is appearing as a NASA Special Publication and bears the designation NASA SP-7011. The first issue included pertinent references which appeared during the first half of 1964. To date, five supplements to the first issue have been published and others will be distributed at regular intervals in the future. Issues that have already been published are:

Publication Number	Date of Issue	Price
SP-7011	July 1964	$2.00
SP-7011(01)	August 1964	1.00
SP-7011(02)	September 1964	1.00
SP-7011(03)	October 1964	1.00
SP-7011(04)	November 1964	1.00
SP-7011(05)	December 1964	1.00

This bibliography, as well as SP-7011 and its supplements, can be obtained without charge by NASA offices and contractors, other U.S. Government Agencies and their contractors, and non-governmental organizations that are working in direct support of NASA programs. Requests for copies and additional information should be addressed to NASA's Scientific and Technical Information Division (Code ATSS-AD). Other organizations and individuals can purchase copies from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va., at the prices listed above.

ABBREVIATIONS

The abbreviations used herein for journal titles are intended to save space without sacrificing ready recognition. Minor words such as articles and prepositions, and occasionally parts of long titles have been omitted, and the words and names occurring most frequently in titles are abbreviated. The following is a key to the title word abbreviations used:

Acad.	Academy
Acoust.	Acoustic
Aeronaut.	Aeronautical
Amer.	America(n)
Arch.	Archives
Assoc.	Association
Bacteriol.	Bacteriology
Brit.	British
Bull.	Bulletin
Canad.	Canadian
Coll.	College
Compar.	Comparative
Corp.	Corporation
Dept.	Department
Dermatol.	Dermatology
Div.	Division
Elec.	Electrical
Endocrinol.	Endocrinology
Eng.	Engineering
Exper.	Experimental
Gaz.	Gazette
Gynecol.	Gynecology
Hyg.	Hygiene
Inc.	Incorporated
Indus.	Industrial
Inst.	Institute
Jour.	Journal
Lab(s).	Laboratory(-ies)
Laryngol.	Laryngology
Mag.	Magazine
Med.	Medicine, Medical
Nat.	National
Ophthalmol.	Ophthalmology
Otol.	Otology
Otolaryngol.	Otolaryngology
Pathol.	Pathology
Physiol.	Physiology
Proc.	Proceedings
Psychol.	Psychology
Quart.	Quarterly
Rev.	Review
Sci.	Science
Scient.	Scientific
Soc.	Society
Surg.	Surgery
Tech.	Technical
Univ.	University

BIBLIOGRAPHY

1. GENERAL ASPECTS

a. General

1
Brown, Kenneth
TRANSPORTATION. —— In: Space logistics engineering, p. 548-570. Ed. by Kenneth Brown and L. D. Ely. New York: John Wiley and Sons, 1962.

In contrast to earth transportation, space vehicles are specialized machines designed for a specific mission. The route, once determined, will dictate the power needed for sufficient total velocity to complete the mission proposed. A table is included of velocity values for 200-, 20,000-mile, lunar, and interplanetary missions. A description, with illustrations, is presented of the philosophic and logistic considerations for three different missions: (1) transportation of troops or equipment from one spot on earth to another using a space transport glider; (2) manned satellite; and (3) unmanned moonmobile and one- and three-man vehicles transporting space travelers from one lunar colony to another. Concepts for escape and protection in space vehicles are discussed.

2
Chamberlin, J. A.,
and A. J. Meyer
PROJECT GEMINI DESIGN PHILOSOPHY.—Astronautics and Aerospace Eng., 1 (1): 35-39. Feb. 1963.

The primary objectives of Project Gemini include the following: (1) to provide a logical follow-up to Project Mercury, with a minimum of expense and time; (2) to subject two men and their supporting equipment to long-duration flights in space, a requirement for lunar trips and beyond; (3) to rendezvous and dock with another orbiting vehicle; (4) to maneuver a spacecraft in space after docking to a new propulsion system; (5) to experiment with men climbing out of the spacecraft for short periods while in orbit; and (6) to perfect methods for returning and landing the spacecraft on a small preselected land site. One of the most important differences in design philosophy between Mercury and Gemini is greater reliance on the astronauts to control the Gemini spacecraft. Other differences exhibited by Gemini include use of ejection seats for escape, modular design for the systems, and the elimination of certain Mercury hardware, such as the periscope, landing bag, and the large reserve parachute.

3
Gazenko, O. G.
[SOME PROBLEMS OF SPACE BIOLOGY] Nekotorye problemy kosmicheskoi biologii. —— Vestnik Akademii nauk SSSR (Moskva), 32 (1): 30-34. Jan. 1962. In Russian.

Reports presented at the meeting of the Department of Biological Sciences, Academy of Science, USSR, in Moscow on October 3-5, 1961, on problems of space biology are reviewed. At present the core problems of space biology are: (1) the effect of extreme environmental factors in space on terrestrial organisms; (2) the development of biological bases for the protection of the crew on space flights and on other planets; and (3) investigation of extraterrestrial conditions and forms of life. The factors of space flights which affect living organisms adversely, may be grouped as follows: (a) g-forces, vibration, noise, weightlessness; (b) ultraviolet, infrared, and visible ranges of radiation, ionizing radiation, concentration of gases and solid matter, temperature extremes, etc.; and (c) isolation, restriction of space, peculiarities of microclimate, diurnal rhythms, nutrition, etc. Both Russian cosmonauts felt a change in the heart beat, dizziness, and sickness under weightlessness. Biotelemetry is discussed in view of its importance in space biology. Recently techniques have been developed for the study of coordination of voluntary movements in man, brain circulation, etc.

4
Gillespie, R. W.,
R. V. Ragsac, and S. Ross
PROSPECTS FOR EARLY MANNED INTERPLANETARY FLIGHT.—Institute of Aerospace Sciences, New York, N. Y. IAS Paper no. 63-84, 1963. (Presented at the 31st Annual Meeting, New York, N. Y., Jan. 21-23, 1963).

Prospects and requirements for manned interplanetary flights to Mars and Venus during the first half of the 1970's are discussed. Mass requirements and mission durations are presented for single- or multi-planet flybys as well as for short orbiting capture missions. Vehicle technology of the advanced Apollo period is assumed. Major emphasis is placed on the desire for a limited planetary exploration program which will not seriously compete with the national lunar program for either funding resources or development effort. Alternative calculations are performed using both conservative and sophisticated subsystem capability assumptions to assess, in a coarse sense, the areas of maximum sensitivity to opposition period, trip duration, and major subsystem choice. (Authors' abstract)

5
Gilruth, R. R.
MAN'S GREATEST EXPLORATION.—Grumman Horizons, 2 (1): 12-16. Spring 1963.

The space program conducted by National Aeronautics and Space Administration is summarized with respect to Mercury, Gemini, and Apollo programs. The goal is to have the three-man spacecraft under the Apollo program to make the round-trip to the Moon and back in the late sixties. The function of the three major elements of the Apollo spacecraft, the Command, the Service, and the Lunar Excursion Modules, is described in some detail.

6
Holmes, D. B.
[THE FUTURE OF PILOTED SPACE FLIGHTS] L'avenir des vols spatiaux pilotés. — Homme et l'espace (Lausanne), no. 12: 20-21. March 1962. In French.

Project Mercury intends to send man on orbital missions for 24 hours in 1962 and 1963. Following this, the Apollo project anticipates a one-week mission around the earth. Flights of the Apollo project will be equipped for two, and ultimately three men. These space ventures will provide valuable orbital astronomical observations of the stars and planets, and especially of the moon.

7
Horsford, C. E. S.
A BRITISH CODE OF SPACE LAW.—Spaceflight (London), 5 (2): 52-53. March 1963.

A summary is presented of the yet unpublished British space code. This code was written by a group of international lawyers, and has been sent to the United Nations' space committee. The code establishes liability for all damage done by space operations to persons and property on Earth. A limit of $50,000,000 is provided for payment of damages.

8
[MAN IN SPACE] L'uomo nello spazio. — Ulisse (Firenze), 7: 1-143. June 1962. In Italian.

This is a collection of papers dealing with space flight. Pertinent articles are abstracted separately, see items no. 14, 24, 36, 72, 166, 781, 893, 1806.

9
Musgrave, P. W.
AVIATION MEDICINE—TRANSITION TO SPACE. — Texas State Jour. Med., 58 (1): 37-39. Jan. 1962.

The physiological effects of decreased oxygen supply, temperature, and atmospheric pressure were among the first problems to be encountered in aviation medicine. With the advent of space flight the major new medical problems are weightlessness, radiations, and psychological and physiological impact resultant from man's separation from the earth. These problems are being solved by application of familiar principles of the basic medical sciences.

10
Page, W.
CAN SPACE PROLONG YOUR LIFE? — Space World, 2 (4): 42, 56-58. March 1962.

It is possible that out of space exploration may come medical marvels which will reduce disease on earth, provide startling new cures, save doomed patients, reveal a new line of wonder drugs, and even prolong human life. It is suggested that zero-g weightlessness and certain radiations may be beneficial in the treatment of specific diseases, that future hospitals will be found in orbit, and that surgeons may operate under 100% germ-free conditions in space.

11
Perkins, C. D.
MAN AND MILITARY SPACE.—Jour. Royal Aeronaut. Soc., 67 (631): 397-412. July 1963

An overall view is given of the history and development of the United States space program from its inception up to the present day. Present and future programs such as Project Appollo and Project Gemini are discussed as to objectives and usable results of the missions. The role of man in military space missions is both costly and open to question as to effectiveness and efficiency. The inclusion of man in the space mission must be based on valid reasons, and the job must be unique and clearly defined. Concepts of man being used as a reconnaissance system, or in space dog fighting, or in strategic bombing are invalid. Military oriented missions such as navigation, mapping, surveillance, communication, etc. can probably be best done without man involved. A space station where man could be best used for the maintenance, repair, and inspection of equipment might offer a solution to man's role in space.

12
Tobias, C. A.,
and J. V. Slater
OUR VIEW OF SPACE BIOLOGY WIDENS. — Astronautics, 7 (1): 20-22, 47-52. Jan. 1962.

Putting a man safely into space requires knowledge concerning his ability to withstand the stresses resulting from acceleration-deceleration, weightlessness, temperature changes, vibrations, tumbling, artificial gas environments, and radiations. The importance of biological research in the space program is emphasized. For example, in radiobiology, two aspects under study are the neurological effects of radiation, and its developmental effects on embryonic forms. Weightlessness is a challenge to the biophysicist. Underlying physical causes for the effects of weightlessness probably involve alterations in convection patterns of liquids and gases. These appear to change the mode of mixing and the phase changes and might also result in reduced cell division. Many examples are given of phenomena both observed and considered for future research.

b. History

13
Benson, V. G.,
and R. D. Squires
AEROSPACE MEDICAL ASPECTS OF U.S. NAVY MANNED BALLOON FLIGHT OF 4 May 1961 "STRATO-LAB HIGH NO. 5". —— Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask no. MR005.13-0002.2, Report no. 11). Report no. NADC-MA-6208, Aug. 20, 1962. iii+11 p.

This paper presents medical considerations and results pertinent to the Strato-Lab High No. 5 balloon flight during which two naval officers reached a record altitude of 113,733 feet in an open gondola while wearing the Navy-Mercury full pressure suits. The flight provided means for testing (1) the complete capabilities of the full pressure suit for a prolonged period of time in an actual space-equivalent environment and (2) biotelemetry methods for measuring the physiological reactions of the subjects. The operation and functioning of the full pressure suit and the performance of the pilots during the flight is discussed. The temperature control capability provided by the venetian-blinds system in the gondola is examined and the physical status of the pilots, as indicated by bioinstrumentation data, is summarized. (Authors' abstract)

14
Blagonravov, A. A.
[PREPARATION FOR SPACE FLIGHT] La preparazione del volo spaziale.— Ulisse (Firenze), 7: 71-77. June 1962. In Italian.

A brief discussion is given of the historic development of space flight in the Soviet Union prior to manned orbital flight, including the experiments with dogs (Laika, Belka, Strelka, Zvezdochka, and Chernushka). Some of the environmental and physiological parameters telemetered during the flights are presented.

15
Bland, W. M.,
and C. A. Berry
PROJECT MERCURY EXPERIENCES.—Astronautics and Aerospace Eng., 1 (1): 29-34. Feb. 1963.

Salient features of the Project Mercury program are reviewed, including biomedical and scientific results. The careful and continuing attention given to detail in all phases of the program, from design through flight training, is described. The following are listed: (1) some of the more significant medical information gathered in the project, (2) contributions to knowledge in the natural sciences, and (3) the management structure which has been evolved. The accomplishments of the last Mercury orbital mission, that of Astronaut Walter M. Schirra, left no doubt that man, the Mercury space systems, and the manned spaceflight organizations are ready for more extended missions. Work is already underway for accomplishing the next facet of the manned space program, the manned one-day mission, during the first half of 1963.

16
Carpenter, M. S.
PILOT'S FLIGHT REPORT. —— In: Results of the second United States manned orbital space flight, May 24, 1962, p. 69-75. Washington, D. C.: National Aeronautics and Space Administration, 1962.

An account of the major events and personal observations of the MA-7 flight is reviewed by the pilot. Prior to and during powered flight, launch-vehicle noise and vibration were less than expected. As in the MA-6 mission, the astronaut quickly adapted to weightless flight and remarked that it was more comfortable and provided greater mobility than under normal gravity. Astronaut Carpenter also observed the space particles and the bright horizon band, previously reported by Astronaut John H. Glenn, Jr., and secured new information on both phenomena. The final phases of the flight, including retrosequence, reentry, landing, and egress, are covered in detail. (Author's summary)

17
[THE CHIMPANZEE ENOS OPENS THE WAY TO SPACE TO AMERICAN ASTRONAUTS] Le chimpanzé Enos ouvre aux astronautes américains la voie de l'espace. —— Homme et l'espace (Lausanne), no. 10: 2-3. Jan. 1962. In French.

The two-orbit flight of the chimpanzee "Enos" around the earth on November 29, 1961, in a Mercury capsule is briefly discussed. The flight lasted for 3 hours and 20 minutes. By means of conditioned reflexes and arduous training, the chimpanzee was able to manipulate a series of levers and perform certain tasks during the flight. Data accumulated from this flight were of great value in preparing the way for the space flight of John Glenn.

18
[Corazzi, U.]
[COULD WE LIVE IN SPACE?] Possiamo vivere nello spazio?—Oltre il cielo (Roma), 5 (90): 271-274. Oct. 1-15. 1961. In Italian.

A biographical sketch is presented of Colonel Professor Rodolfo Margaria, director of the Institute of Physiology of the University of Milano. Included is a review of his various studies on high altitude physiology, aviation medicine, space flight physiology, the problem of mammalian resistance to acceleration, protection from accelerative forces, the effects of zero gravity on the otolithic apparatus, respiration and position sense, and the effects of interplanetary voyages on the central nervous system and mental condition.

19
Diamond, E.
[SEVEN ASTRONAUTS FOR SEVEN VITAL MISSIONS] Sept astronautes pour sept missions vitales. —Homme et l'espace (Lausanne), no. 12: 6-7. March 1962. In French.

Although the orbital flight mission of John Glenn was a solitary one, it was the result of the combined efforts of the six other American astronauts. Malcolm Scott Carpenter acted as Glenn's stand-in in the event of a last minute mishap, Alan Shephard (first to make the Mecury Project's suborbital flight) was his instructor, and Donald Slayton monitored communications with the launched space capsule. The other astronauts were placed at tracking stations in Australia, California, and Bermuda.

20
Douglas, W. K.
AEROSPACE MEDICINE.—Texas State Jour. Med., 59 (3): 182-186. March 1963.

A brief review is presented of the history of aviation medicine beginning with the early balloon flights in the 1800's. Included among the various physicians who participated in programs to conquer space were M. W. Boynton, 1944, fatal jump from high altitude; J. P. Stapp, 1954, exposed to decelerative forces of 35 g on a rocket-propelled sled; D. G. Simmons, 1957, balloon flight which attained an altitude of more than 100,000 ft. Also discussed are the peculiarities of space medicine, selection and training of astronauts, and training of space physicians.

21
Ducrocq, A.
[AFTER THE ORBITAL FLIGHT OF COLONEL GLENN] Après le vol orbital du Colonel Glenn. — Homme et l'espace (Lausanne), no. 11: 2-5. Feb. 1962. In French.

American space efforts (1958-1961) ranging from the launching of the chimpanzees "Ham" and "Enos" to the suborbital flights of Alan Shephard and Virgil Grissom are briefly reviewed, along with the orbital flight of John Glenn in 1962. Consideration is given to the development of the Mercury capsule and to the development of future cabins equipped to carry two or possibly three astronauts into space for long periods of time.

22
Fedorov, E. K.
[ACCOMPLISHMENTS OF SOVIET SCIENCE IN SPACE RESEARCH] Les réalisations de la science soviétique dans la recherche spatiale. — Monde scientifique (London), 6 (1): 17-24. 1962. In French.

A review is presented of Soviet space research from 1957 to 1961, dealing with space technology, interplanetary and lunar flights, orbital cosmic ships, and the flights of astronauts Y. A. Gagarin and G. Titov. Extensive studies have been made on space biology, cosmic rays, and structure of the space environment. Consideration is given to international cooperation in space research and future perspectives. Included is a diagram of Sputnik III showing its scientific equipment.

23
FIRST GROUP FLIGHT IN SPACE—A TRIUMPH OF SOVIET SCIENCE.—Sci. and Culture (Calcutta), 28 (10): 444-448. Oct. 1962.

The flights of Andrian Nikolaev and Pavel Popovic, the first astronauts to make a group space flight while performing coordinated activities, are discussed. The spaceships Vostok III and Vostok IV had elliptic orbits of flight. The Vostok IV was launched on August 12, 1962, 23 hours and 32 minutes after the start of Vostok III. According to available data, at 21 hours on August 14 the parameters of their orbits were the following: maximum distance from the earth's surface 214 and 224 kilometers, minimum distance 170 and 173 kilometers, periods of revolution, 88.208 and 88.179 minutes, respectively. Consideration is given to orbital maneuvers, methods of external guidance of spaceships, and the spaceships' control system, automatic guidance system, velocity meter, system of stabilization and orientation, and automatic devices.

24
Gallarati, G.
[RECENT ACCOMPLISHMENTS AND OUTLOOK FOR THE FUTURE] Le ultime realizzazioni e le prospettive per il futuro.—Ulisse (Firenze), 7: 86-91. June 1962. In Italian.

This is a general discussion of the accomplishments of space flight in the recent past and of prospective future developments, particularly with regard to new propulsion systems. A table (p. 88) gives a comparative analysis of six orbital flights carried out by astronauts of the Soviet Union and of the United States.

25
Gazenko, O. G.
MEDICAL PROBLEMS OF MANNED SPACE FLIGHT. — Space Sci. Reviews (Dordrecht), 1 (3): 369-398. March 1963.

A review is presented of the methods and results of Soviet scientific research dealing with the medical problems of human space flight. Studies were made of: (1) the effect of space flight (vibrations, accelerations, weightlessness, cosmic, ultraviolet, ionizing radiations) on man and experimental animals, and means of protection; (2) medical requirements during flight such as capsule air conditioning, emergency systems, sanitary and hygienic equipment; (3) selection and training of crew members; (4) biological conditions necessary for prolonged spaceflight to ascertain systems for maintaining living conditions for the crew (biological regenerating systems, utilizing solar energy); and (5) conditions of life functions and extraterrestrial life forms and working out problems related to the prevention of contamination of space with living matter. A table is given listing the dates and characteristics of space flight experiments in Russia during 1957-61, and the physiological data derived from them.

26
Gazenko, O. G.,
V. I. Iazdovskii, and V. N. Chernigovskii.
[MEDICO-BIOLOGICAL STUDIES IN ARTIFICIAL EARTH SATELLITES (EXPERIMENT WITH THE DOG "LAIKA")] Mediko-biologicheskie issledovaniia na iskusstvennykh sputnikakh zemli (opyt s sobakoi Laikoi)—Problemy kosmicheskoi biologii (Moskva), 1: 285-288. 1962. In Russian, with English summary (p. 288).

Prior to space flight the animals selected underwent special training including development of the ability to withstand prolonged confinement, to wear special suits, and to defecate into special devices. For this purpose, construction of a suitable capsule and modifications of measuring instruments were required. It was found useful to duplicate instrumentation and telemetry channels, whenever possible. Special automatic feeding devices had to be designed. It was assumed that the direction of g forces should act transversally to the body axis of the animal. The studies carried out during orbital flight made it possible to compare and correlate the data obtained with those accumulated during the laboratory experiments.

27
Generales, C. D. J.
SELECTED EVENTS LEADING TO DEVELOPMENT OF SPACE MEDICINE.—New York State Jour. Med., 63 (9): 1303-1312. May 1, 1963.

A historical review of space medicine is presented, from the first mythological flights of Wan Hu powered by 47 coolie-fired rockets, up through the 17th and 18th centuries with Boyle, the Mongolfier brothers, Lunardi, Charles, and Jeffries, to the mid-19th century and the ascent of Tissandier with his two companions. The author reports on his early experiments on the effects of centrifugation on mice in the early 1930's with Wernher von Braun.

28
Glenn, J. H.
SUMMARY RESULTS OF THE FIRST UNITED STATES MANNED ORBITAL SPACE FLIGHT. — National Aeronautics and Space Administration (Washington, D. C.). [Unnumbered report], May 3, 1962. 27+[29] p.

Also published in: Life sciences and space research, p. 160-183. Ed. by R. B. Livingston and others. Amsterdam: North-Holland Publishing Co., 1963.

This paper describes the principal findings of the first U.S. manned orbital space flight in light of the flight mission. Consideration is given to the coordinated tracking network, recovery forces, and to the spacecraft and its several functional systems. These include mechanisms for heat protection, escape maneuvers, spacecraft control, power supply, communications, life support, and landing. A few difficulties encountered in the flight and deviations from the planned sequence are described. Craft preparation, aeromedical studies, flight plan, and particularly flight observations—including the color, light, horizon visibility by day and by night, cloud formations, and sunrise and sunset effects are given in some detail. The general conclusion from the MA-6 flight is that man can adapt well to new conditions encountered in space flight and that he can contribute to mission reliability and mission achievement through his capacities to control the spacecraft and its multiple systems. He can also contribute to decision making and adaption of programming as well as to direct exploratory and experimental observations. (Author's abstract)

29
Gorman, H. A.
ANIMALS ... THE WORLD'S FIRST ASTRONAUTS. — Small Animal Clinician, 2 (8): 461-468. Aug. 1962.

A review is presented of animal tests performed in an effort to discover the secrets of outer space. Experiences and data, from the first space probe with animals in 1947 to those of the Mercury Program, are outlined. Results of these tests that were subsequently utilized for human flights are discussed, including bioinstrumentation, the astronaut's couch, and the Mercury capsule escape mechanism.

30
Lomonaco, T.
[BIOLOGICAL CONSIDERATIONS ON THE PRESENT STATE OF SPACE FLIGHT] Considerazioni biologiche sui voli spaziali eseguiti fino ad oggi. — Rivista di medicina aeronautica e spaziale (Roma), 25 (3): 431-449. July-Sept. 1962. In Italian, with English summary (p. 446-447).

A review is presented of the physiobiological data derived from Russian, American, and French suborbital and orbital flights utilizing animals and humans from 1949 to 1961. The experiments culminated in the orbital flights of the Soviet astronauts Gagarin and Titov in 1961. Neither showed any significant change in cardiovascular or respiratory function during the active phase of the flight. No changes were observed during the period of weightlessness, and no disorders of motion or muscle coordination were recorded. Only Titov suffered from nausea and vertigo for several moments. The first American suborbital flights (1961) were accomplished by Shepard and Grissom, and on February 20, 1962, Colonel John Glenn manned the first orbital flight. Telemetered biological parameters showed Glenn's cardiovascular functions in hyper- and zero-gravity to correspond to previously observed data. Sensory function underwent no change except for a reduction of twilight vision. No labyrinthine disorders were observed during zero-gravity although the astronaut attempted to elicit them by voluntary head movements. On May 24, 1962, the American pilot Carpenter was launched into orbit. During weightlessness he exhibited tachycardia and great changes in blood pressure.

31
Medvedeff, M.
[PHYSIOLOGICAL RESPONSES OF THE ASTRONAUT GLENN: RESULTS OF THE FIRST AMERICAN PILOTED SPACE FLIGHT (FEBRUARY 20, 1962), MERCURY-ATLAS MISSION OR MA-6] Les réponses physiologiques de l'astronaute Glenn: résultats du premier vol spatial américain avec pilote (20 fevrier 1962), mission Mercury-Atlas ou MA-6.—Presse médicale (Paris), 70 (36): 1717-1718. Aug. 25-Sept. 1, 1962. In French.

The orbital space flight of astronaut Glenn provided much valuable information concerning the physiological reactions (blood pressure, pulse rate, body temperature, electrocardiography, etc.) of man under conditions of space flight. Subgravity conditions, accelerations of take-off and re-entry, and the transitional periods of weight changes produced no significant physiological dysfunction in the astronaut. Bio-sensory data, subjective evaluation of the pilot and of general body sensations during the flight provided much physiological information. Observations were also made of various body functions such as orientation in space, eating, micturation, and effort during the flight.

32
Parin, V. V.,
and V. I. Iazdovskii
ADVANCES IN SPACE PHYSIOLOGY IN THE SOVIET UNION.—Sechenov Physiol. Jour. USSR (Elsevier Pub. Co., Amsterdam), 47 (10): 1-6. 1962.

English translation of: Put' sovetskoi kosmicheskoi fiziologii.—Fiziologicheskii zhurnal SSSR (Moskva), 47 (10): 1217-1226. Oct. 1961. In Russian.

The first and second stages of animal experiments in Soviet space medicine and biology were carried out with rocket flights. Satisfactory data were obtained on physiology and behavior under space-equivalent stresses and on the adequacy of hermetic cabins, cabin equipment, space suits, and recovery equipment. The orbital flight of the dog, Laika, confirmed that a highly organized organism can survive space flight in a satisfactory condition. Other satellite flights with different types of animals allowed continuous observations of their condition throughout the flight and during landing. The final stage was preceded by the selection and training of cosmonauts. The training program subjected the cosmonauts to simulated stresses gradually increasing in intensity until the levels expected in space were exceeded. Careful medical observations were made throughout the training. The results of this preparation were seen in the successful flight of Gagarin. In Titov's flight prolonged weightlessness affected his vestibular sense organs but not his efficiency. Recovery after the flight was rapid.

33
Parin, V. [V.]
and V. Iazdovski
AEROSPACE MEDICINE AND PHYSIOLOGY SUCCESSES IN SOVIET UNION.—Santé publique (Bucharest), 5 (1): 3-14. 1962. In English.

A review is presented of Soviet medical and biological research efforts relative to space flight. Included is a historical analysis; an outline of the factors affecting the body under space flight conditions (weightlessness, barometric pressure and temperature changes, accelerations, hazards from ultraviolet light and meteorites, etc.); and evaluation of rocket flight animal experiments, especially the flight of the dog "Laika" on the second Soviet artificial earth-satellite. Some medical aspects of the first (Yuri Gagarin, April 1961) and second (Gherman Titov, August 1961) manned space flights are also discussed.

34
RESULTS OF THE SECOND U. S. MANNED ORBITAL SPACE FLIGHT, MAY 24, 1962. —— National Aeronautics and Space Administration, Washington, D. C. [Unnumbered report], [1962]. v+107 p.

Discussions are presented of performance of the spacecraft and launch systems, the modified Mercury Network, mission support personnel, and the astronaut (M. Scott Carpenter), together with analyses of observed space phenomena and the medical aspects of the mission. These form a continuation of the information previously published for the first United States manned orbital flight, conducted on February 20, 1962, and the two manned suborbital space flights. An appendix is included of MA-7 air-ground voice communication. Pertinent papers are abstracted separately, see items no. 16, 899, 911, 1826.

35
Ross, M. D.
A CONSIDERATION OF THE U. S. NAVY STRATO-LAB BALLOON PROGRAM AND ITS CONTRIBUTIONS TO MANNED SPACE FLIGHT. —— In: Proceedings of the 2nd National conference on the peaceful uses of space, p. 257-261. Washington, D. C.: National Aeronautics and Space Administration, 1962.

Contributions of the Strato-Lab balloon program to space exploration are reviewed including technological accomplishments, scientific results, and its role as an analog for manned scientific research. It is suggested that the latter represents the greatest contribution, generating thinking about a long-range need for the scientific manned space program. This overshadows by far any specific flight accomplishments of personnel, system development, or true identifiable technological or scientific contributions made to date. A plan for acquiring future space scientists is described.

36
Sisakian, N. M.
[BIOLOGICAL PROBLEMS POSED BY COSMIC FLIGHT] I problemi di biologia proposti dai voli cosmici.—Ulisse (Firenze), 7: 51-60. June 1962. In Italian.

The study of cosmic biology can be divided into five successive phases: (1) study of the physical characteristics of the upper atmospheric layers; (2) suborbital flight of experimental animals in high-altitude rockets to investigate the physiological effects of flight; (3) orbital flight of longer duration, with telemetered information on the space cabin environment and the physiological condition of the animal; (4) orbital flight of animals and their return to the ground, to study possible after-effects; and (5) manned orbital flight. So far these studies have confirmed human tolerance to acceleration, weightlessness, and cosmic ray exposure below the radiation belts of the Earth for at least 24 hours. Some of the physiological data obtained from the flights of J. Gagarin and G. Titov are given. Actual problems still to be solved before interplanetary flights can be attempted concern protection from intense ionizing radiation (e.g., of solar flares) and maintenance of proper cabin atmospheres. Flights to other planets would give a definitive answer to the question of the existence of extraterrestrial life.

37
[A SECOND AMERICAN ASTRONAUT HAS BEEN PUT IN TERRESTRIAL ORBIT] Un second astronaute américain a été mis sur orbite terrestre.—Homme et l'espace (Lausanne), no. 13: 3-5. July 1962. In French.

The orbital flight of Malcolm Scott Carpenter three times around the earth on May 24, 1962, is briefly discussed. The experience of the astronaut during landing the capsule 200 miles from the planned recovery area prompted the development of new landing and recovery system techniques. Part of the conversation between the astronaut and the ground from

13:45-20:45 hours is presented, along with miscellaneous illustrations.

38
Sergeev, A. A.
[ESSAYS ON THE HISTORY OF AVIATION MEDICINE] Ocherki po istorii aviatsionnoi meditsiny. —300 p. Moskva: Akademiia nauk SSSR, 1962. In Russian.

The author discusses the history of aviation medicine, spanning the period from the late 19th century to the conclusion of World War II. The presentation is based mainly on Russian sources, and the bibliography listings terminate with the year 1952. The book contains the following chapters: Prehistory of aviation medicine; Initial period of the development of aviation medicine; State of foreign aviation medicine during World War I and immediately thereafter; Birth and development of Soviet aviation medicine; Foreign aviation medicine during the years 1920-30; The flourishing of the Soviet aviation medicine; The contribution of Soviet mountain physiologists to the aviation medicine; and Soviet aviation medicine during World War II. (1838 references)

39
Simons, D. G.
MANHIGH BALLOON FLIGHTS IN PERSPECTIVE. — In: Proceedings of the 2nd National conference on the peaceful uses of space, p. 243-248. Washington, D. C.: National Aeronautics and Space Administration, 1962.

The objectives, experiences, and lessons learned during Manhigh balloon flights II and III are reviewed and the relation of these to present and future manned space efforts are presented. In Manhigh II, decrements in performance resulting from fatigue and warm temperature were noted; Manhigh III proved the value of thorough physiological monitoring. The lessons learned in the Manhigh program define a new challenge, the relation of the performance of the mind with the function of the body. This can only be achieved by rigorous step-by-step neurophysiological understanding of how the mind works. Advances in modern brain research and electronics are essential for space medicine and promise great benefit to all medical sciences.

40
Sisakian, N. M.,
and V. N. IAzdovskii, editors
[THE FIRST COSMIC FLIGHTS OF MAN] Pervye kosmicheskie polety cheloveka.—204 p. Moskva: Akademiia Nauk SSSR, 1962. In Russian.

The development of Soviet aerospace medicine was preceded by an extensive study of physiological effects of physical stresses on functions of a living organism. The primary studies of the effects of acceleration, low atmospheric pressure, high temperature, weightlessness, and other physical factors were performed in the laboratory on experimental animals. Simultaneously, precision instruments and telemetry systems were being developed, which were necessary for the spacecraft performance and the accumulation of physiological data. The information thus gained was utilized in unmanned space rockets and orbital spacecraft tryouts, with experimental animals on board. A rigorous physical training of spacecrew and the development of their dexterity in manipulating craft systems were followed by trails in the mockup units. During the actual missions accomplished by the first two astronauts IU. A. Gagarin and G. S. Titov, a volume of data was recorded, which after processing gave valuable information necessary for planning further missions in the space exploration program.

41
SPACEFLIGHT: THE FIRST FIVE YEARS.—Spaceflight (London) 5 (3): 87-101. May 1963.

A comprehensive listing in table form is given of all the artificial Earth satellites launched since Sputnik 1 in 1957. These satellites include those used for biological experimentation. Launch date, lifetime, size, shape, and weight of the satellites are listed. Also given are the various characteristics of orbital flight such as nodal period, perigee, apogee, etc. This information will be published some time in the future in the Teachers' Handbook of Astronautics by The British Interplanetary Society.

42
Titov, G. [S.]
MY DAY IN SPACE. — Spaceflight, 4 (5): 146-150. Sept. 1962.

This is an abridged version of the speech made by the Russian astronaut German Titov on May 3, 1962, at the 3rd Space Science Symposium in Washington, D. C. Various aspects of his 17-orbit flight of August 6-7, 1961, discussed included launching, entering orbit, actual flight, re-entering the atmosphere, and landing. The basic physiological functions conformed well to flight loads and stresses. The flight indicated that man can withstand the effect of weightlessness for 24 hours. Some motion sickness was encountered which later abated, but eating, drinking, muscle coordination, and task performance remained good. The flight was preceded by two preparatory stages, a training program consisting of theoretical, special, physical, medicobiological, technical, and flight factors; and an immediate preflight period.

43
Titov, G. S.
PREPARATION AND RESULTS OF A 24-HOUR ORBITAL FLIGHT.—In: Life sciences and space research, p. 128-140. Ed. by R. B. Livingston and others. Amsterdam: North-Holland Publishing Co., 1963.

The flight of Vostok II, on August 6-7, 1961, was conducted for the purpose of determining whether man can stay and work effectively and whether all systems of the spaceship can operate successfully during a 24-hour period of orbital space flight. Preparation for the flight included the study of theoretical and applied subjects, testing in various apparatus which provide acceleration, heat, and isolation experience, brief airborne weightless flights, parachute landings, and extensive training in a simulated spacecraft. The space ship made 17 orbits around the Earth and landed 25 hours, 18 minutes after take-off. The space ship was fully pressurized, confortable, and maneuverable. During the flight, it was possible to make observations and take pictures of the earth and its cloud cover, eat meals, and sleep. The mild symptoms suggestive of seasickness were aggravated by head turning, ameliorated by sleep, and entirely relieved by resumption of g-load during descent. (Author's abstract, in part)

44
Walters, H. B.
HERMANN OBERTH: FATHER OF SPACE TRAVEL.—xxix+169 p. New York: Macmillan Co., 1962.

This is a biography of Hermann Oberth, 1894- , who contributed greatly to the development of space flight. He offered the mathematical theory of rocket performance, the theoretical proof of the feasibility of space flight and discussed the problem of weightlessness, as well as suggesting and developing such devices as liquid oxygen-alcohol rockets, multistage rockets, regenerative cooling, veil cooling, automatic steering by inertial devices, gyroscopes, and servomotors. Included are numerous illustrations, a glossary, synoptic calendar, bibliography, and index.

45
Webb, J. E.
[THE MERCURY PROJECT AND THE ACHIEVEMENT OF JOHN GLENN] Le projet Mercury et l'exploit de John Glenn.—Homme et l'espace (Lausanne), no. 12: 2-3. March 1962. In French.

For 32 months the seven Mercury project astronauts were trained under simulated space ship and space flight conditions. They were subjected to experiments with accelerations, weightlessness, and isolation. Intensive instruction was provided in the field of aviation medicine, astronomy, meteorology, and astronautics. The value of engineering, equipment, and the astronauts was demonstrated by the suborbital flights of Alan Shephard and Virgil Grissom, and the orbital flight of John Glenn.

c. Reviews, Treatises, Handbooks, etc.

46
Caidin, M.,
and G. Caidin
AVIATION AND SPACE MEDICINE: MAN CONQUERS THE VERTICAL FRONTIER. —— 215 p. New York: E. P. Dutton & Co., Inc. 1962.

This is a popular treatise on aviation and space medicine illustrated with many photographs. Topics discussed include the upper atmosphere, historical aspects of aviation medicine, high altitude flight, oxygen supply during flight, decompression chamber flight, pressurization and pressure suit, explosive decompression, gravity, vertigo, zero gravity, and escape and survival.

47
Ellingson, H. V.
AVIATION MEDICINE. —— In: The Cyclopedia of medicine, surgery and specialties, Review service, 1962, p. 213-237. Edited by G. M. Piersol and others. Philadelphia: F. A. Davis Co., 1962.

This chapter reviews the entire field of aerospace medicine and is aimed at providing current, revised information to the medical profession. General topics discussed include the following: space medicine (closed systems, weightlessness, artificial gravity, human engineering, psychological factors, radiations, instrumentation); aviation physiology (g-tolerance, vibration, pressure breathing, oxygen toxicity, motion sickness); personal equipment (pressure suits, oxygen equipment); the specialties (otorhinolaryngology, ophthalmology, neuropsychiatry, cardiology); aircrew selection and maintenance (selection tests, care of flyers, Federal Aviation Agency); air travel (epidemiology of air travel, private flying, transportation of patients, oxygen in transport, treatment of motion sickness); flying safety (accident investigation); and reactions to flight (dysbarism). (72 references)

48
Gerathewohl, S. J.
PRINCIPLES OF BIOASTRONAUTICS.—xvii+557 p. Englewood Cliffs, N. J.: Prentice-Hall, 1963.

This is a handbook of bioastronautics, reviewing the physical factors and biological conditions of the space environment and space vehicles and their physiological and psychological effects, as well as life support systems designed to enable man to penetrate into space. The following chapters are included: Development of the program; The rocket ship; Space vehicle operations; Biomedical rocket flights; The environment in space; Biophysics of exotic environments; Cosmobiology; The biological effects of the space environment; Orientation in space; Control and performance; Life support; Manned space missions. Many literature references are given in footnotes.

49
NASA LIFE SCIENCES DATA BOOK. —— Webb Associates, Yellow Springs, Ohio (Contract NASr-89); issued by National Aeronautics and Space Administration, Washington, D. C. vi+201 p. June 1962.

This handbook is for designers of aerospace vehicles and equipment and contains a representation of applied research data from various life sciences, especially from applied physiology. With only a few exceptions (which are marked) quantitative human experimental data are included. Graphs, diagrams, nomograms, and tables make up the technical content of the book, each having its own legend setting forth the origin of the material, restrictions applying to the use of the data, and other necessary information. Subjects are presented under the following three main headings: (1) environmental design ranges (atmosphere, force fields, temperature, decompression, radiation); (2) active human exchanges (energy, water, waste); and (3) characteristics of man (size and motion, breathing, senses). Dividers are provided to locate each subject easily.

50
Riley, F. E.,
and J. D. Sailor
SPACE SYSTEMS ENGINEERING. —— ix+323 p. New York: McGraw-Hill Book Co., 1962.

This book is aimed at the general student or technical person interested in the field of space. It is composed essentially of lectures dealing with the interrelated fields of astronautics. Discussions and examples are given in orbit mechanics, vehicle design, propulsion, guidance and control, power supplies, communications, requirements for manned space flight, unmanned space vehicle missions, and manned space systems. Included is a subject index.

51
Slager, U. T.
SPACE MEDICINE.—xi+388 p. Englewood Cliffs, N. J.: Prentice-Hall, 1962.

This is a basic introduction to aerospace medicine, discussing the physical, physiological, and psychological facts of aviation and manned space flight. It is divided into the following chapters: Man's entry into space; The pressure environment; The temperature environment; Non-ionizing radiation; Ionizing radiations; Acceleration and deceleration; Weightlessness; Noise and vibration; Metabolism; Toxicology; Psychology; Ecology of other planets and interplanetary space. In each chapter, the physical factors of the space or cabin environment are described, followed by their physiological effects. Emphasis is given to the pathogenesis, clinical syndromes, treatment, and prevention of pathological conditions liable to be caused by space-flight factors. A bibliography is appended to each chapter.

52
Stine, G. H.
MAN AND THE SPACE FRONTIER.—[iii+]149+vii p. New York: Alfred A. Knopf, 1962.

This book is an attempt to fill in the gap between oversimplified, popular accounts of space flight and the advanced, highly technical writings on the subject, with emphasis on man. Included are chapters on fundamental properties of air and space, pressure, humidity, acceleration, noise, cosmic radiation, isolation and weightlessness, and perspectives for space travel.

53
Weiser, W. J.
THE SPACE GUIDEBOOK.—New revised edition. 325 p. New York: Coward-McCann, 1963.

The various chapters in this popular book deal with cosmic riddles (extraterrestrial life, etc.), the Sun, the Moon, the planets, Mars, comets, asteroids, meteors, space and man himself, rockets, missiles and satellites, project Mercury and the race to the moon, scientific instruments, the stars, and galaxies. Also included is an appendix with profiles of the Mercury astronauts and of the new space pilots, the official box score of satellites in orbit, facts about the solar system, and an index.

d. Miscellaneous Reference Materials

54
Beischer, D. E.,
and A. R. Fregly
ANIMALS AND MAN IN SPACE— A CHRONOLOGY AND ANNOTATED BIBLIOGRAPHY THROUGH THE YEAR 1960. —— U. S. Naval School of Aviation Medicine, Pensacola, Fla. ONR Report no. ACR-64. USNSAM Monograph no. 5, [Jan. 1962]. v+97 p.

A bibliography has been compiled of literature in the field of bioastronautics. This work brings together for the first time a listing of all available reports relating to biological experiments conducted during balloon and rocket flights, with plants, animals, and humans as subjects. This compilation includes a listing of pertinent bibliographies, monographs, technical publications, and periodical articles. Detailed tabulations are given of all known balloon and rocket flights, including such information as flight designation, location, type of experiment, experimental subjects, height, duration, success or failure, investigators, and cross-references to literature. A selective subject index is included, listing experimental material and giving cross-references to literature. Most of the citations are annotated. (Authors' abstract)

55
Jacobius, A. J.,
R. Kenk, L. D. Davis, E. G. Koines, K. Pappajohn, I. M. Terauds, and P. E. Spiegler
AEROSPACE MEDICINE AND BIOLOGY: AN ANNOTATED BIBLIOGRAPHY. VOLUME VI, 1957 LITERATURE.—Library of Congress, Science and Technology Div., Washington, D. C. 1963. vi+358 p.

This sixth volume of the series contains 1567 abstracts and follows the preceding volume in all aspects, including format and type of indexes. Only minor modifications were made in the subject-category breakdown which was initiated in Volume V. New areas of interest that emerged while work was in progress received special consideration. The project is sponsored by the National Aeronautics and Space Administration, the Air Force, and the Federal Aviation Agency.

56
Thomas, L. J.
A BIBLIOGRAPHY OF REPORTS ISSUED BY THE BEHAVIORAL SCIENCES LABORATORY: ENGINEERING PSYCHOLOGY, TRAINING PSYCHOLOGY, ENVIRONMENTAL STRESS, SIMULATION TECHNIQUES, AND PHYSICAL ANTHROPOLOGY, 1946-1962.—Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio. [Unnumbered report], March 1963. v+109 p.

This bibliography lists, by functional groupings, the 907 technical reports, technical notes, contractor reports, memorandum reports, and journal articles prepared by the Behavioral Sciences Laboratory, Ohio, and its contractors, from 1946 through 1962. The functional groups include the following: guides and handbooks applicable to system development; physical anthropology; apparatus; control design and arrangement; environmental stress, vigilance, and work/rest cycles; human engineering applications, descriptions, and evaluations; maintenance; methodology and statistics; personnel and manning requirements; presentation of information; simulation techniques; miscellaneous; systems research; tracking and servo analysis; training and learning; and zero-g studies. An author index is included.

e. Meetings and Symposia

57
[PROCEEDINGS OF THE INTERNATIONAL CONGRESS OF AVIATION AND SPACE MEDICINE, PARIS, SEPTEMBER 1961. II] Communications présentées au Congrès International de Médecine Aéronautique et Cosmonautique, Paris, Septembre 1961. II.—Revue de médecine aéronautique (Paris), 1 (3): 9-89. March-April 1962 In French.

Pertinent papers presented at this congress are abstracted separately.

58
[PROCEEDINGS OF THE INTERNATIONAL CONGRESS OF AVIATION AND SPACE MEDICINE, PARIS, SEPTEMBER 1961. III.] Communications présentées au Congrès International de Médecine Aéronautique et Cosmonautique, Paris, Septembre 1961. III. —— Revue de médecine aéronautique (Paris), 1 (4): 3-77. July-Aug. 1962.

Pertinent papers presented at this congress are abstracted separately, see items no. 267, 512, 837, 853, 971, 1042, 1386, 1402, 1417, 1685, 1820, 1825, 1830, 1923, 1974, 1991, 2138, 2139.

59
[PROCEEDINGS OF THE INTERNATIONAL CONGRESS OF AVIATION AND SPACE MEDICINE, 11, Madrid, October 8-12, 1962] Communicazioni presentate al Congresso Internazionale di Medicina Aeronautica e Cosmonautica, 11°, Madrid, Ottobre 8-12, 1962.—Rivista di medicina aeronautica e spaziale (Roma), 26 (2): 223-262. April-June 1963. In Italian.

Pertinent papers presented at this congress are abstracted separately.

60
INTERNATIONAL CONGRESS ON AERONAUTIC AND COSMONAUTIC MEDICINE. — Industrial medicine and Surgery, 32 (1): 1-43. Jan. 1963.

Papers given in English before the International Congress on Aeronautic and Cosmonautic Medicine, Paris, 1961, are presented. Topics include such items as hypoxic convulsions, acclimatization to high altitudes, pulmonary function evaluation in air and space flight, acclimatization to low concentration of carbon dioxide, the effects of fatigue on cortical reflexes, decompression sickness and air embolism, space orientation, spinal injuries after seat ejection, and seat belt protection during crash deceleration. Papers are abstracted separately, see items no. 270, 324, 745, 966, 1100, 1203, 1889, 1912, 1918, 1933, 2053, 2135.

61
LIFE SCIENCES AND SPACE RESEARCH: A SESSION OF THE THIRD INTERNATIONAL SPACE SYMPOSIUM, WASHINGTON, D. C., APRIL 30-MAY 9, 1962.—Edited by R. B. Livingston and others. xv+184 p. Amsterdam: North-Holland Publishing Co., 1963.

The purpose of the Third COSPAR (Committee on Space Research) Symposium held in Washington, D. C., in 1962, was to describe some of the research findings pertinent to manned space flight and to indicate some of the limitations and problems. The contents are divided into three parts: (1) Perspectives for Exobiology; (2) Basic Studies for Manned Space Flight, including weightlessness problems and effects of cosmic radiation; (3) Results of U.S. and Russian Manned Space Flight. The articles are abstracted separately, see items no. 28, 43, 915, 1050, 1053, 1637, 1652, 1679, 1828, 2159.

62
LUNAR EXPLORATION AND SPACECRAFT SYSTEMS. —Ed. by R. Fleisig, E. A. Hine, and G. J. Clark. ix+201 p. New York: Plenum Press, 1962.

The proceedings are presented of the Symposium on Lunar Flight, held December 27, 1960, in New York City. Pertinent papers include: Radiation shielding of lunar spacecraft by T. G. Barnes, E. M. Finkelman, and A. L. Barazotti; and Panel discussion: "Is there a need for a manned space laboratory?" (see items no. 92 and 2070).

63
[MEETING OF THE NATIONAL DEFENSE MEDICAL SOCIETY, 7th, OCT. 25-26, 1961, TOKYO, JAPAN]. —— Bōei Eisei (National Defense Medical Journal) (Tokyo), 9 (3): 75-198. March 1962. In Japanese.

This issue contains 205 abstracts from the medical field. Abstracts pertinent to aerospace medicine are given separately as items no. 912, 1021, 1022, 1125, 1788.

64
[PROCEEDINGS OF THE INTERNATIONAL CONGRESS OF AVIATION AND SPACE MEDICINE, PARIS, SEPTEMBER 1961. IV] Communications présentées au Congrès International de Médecine Aéronautique et Cosmonautique, Paris, Septembre 1961. IV.—Revue de médecine aéronautique (Paris), 2 (5): 5-44. Nov.-Dec. 1962. In French.

Pertinent papers at this congress are abstracted separately, see items no. 852, 918, 1549.

65
Sharma, R. N.
SYMPOSIUM ON ENVIRONMENTAL PHYSIOLOGY AND PSYCHOLOGY IN ARID CONDITIONS.—Jour. Scient. and Indus. Research (New Delhi), 22 (6): 243-246. June 1963.

Some of the papers presented at the Symposium on Environmental Physiology and Psychology in Arid Conditions are reviewed. This symposium was held in Lucknow, India, during 7-13 December 1962. It was attended by more than 50 scientists from 15 countries. The papers reviewed are included under the following sections: (1) neurophysiology of heat exposure, (2) medical climatology, (3) physiological anthropology, (4) performance and comfort standards, (5) comparative physiology, (6) water and electrolytes, and (7) nutrition and heat.

66
Smith, R. E.,
and others
PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON TEMPERATURE ACCLIMATION (LEIDEN, SEPTEMBER 5-7, 1962.—Federation Proceedings, 22 (3, part I): 687-960.

This is a collection of papers presented at the symposium sponsored by the Netherlands Institute for Preventive Medicine. Pertinent contributions are abstracted separately.

67
SPACE RESEARCH AND TECHNOLOGY: PROCEEDINGS OF SYMPOSIA SPONSORED BY THE BRITISH INTERPLANETARY SOCIETY.—Edited by G. V. E. Thompson. viii+216 p. New York and London: Gordon and Breach Science Publishers, 1962.

The proceedings of five symposia are given. They include: (1) Space Medicine Symposium (1958); (2) Rocket and Satellite Instrumentation Symposium (1960); (3) High Altitude Chambers and Pressure Suits and Their Part in Manned Flight to the Moon [1960]; (4) Space Navigation Symposium (1960); and (5) Liquid Hydrogen Symposium (1961). Pertinent papers are abstracted separately, see items no. 99, 703, 943, 976, 1061, 1090, 1574, 1709, 2177, 2192, 2196, 2317, 2319.

68
SYMPOSIUM ON CLINICAL PROBLEMS IN SCUBA AND SKIN DIVING AND PASSENGER FLYING SPONSORED BY THE NEW HAVEN HEART ASSOCIATION, INC., AND YALE UNIVERSITY, NEW HAVEN, CONNECTICUT, SEPTEMBER 1962.—Connecticut Medicine, 27 (7): 383-401. July 1963.

Pertinent papers presented at this symposium are abstracted separately, see items no. 1957, 1964, 1965.

69
SYMPOSIUM ON MOTION SICKNESS WITH SPECIAL REFERENCE TO WEIGHTLESSNESS.—Aerospace Medical Division. Behavioral Sciences Lab. and Aerospace Medical Research Labs (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-63-25, June 1963. iv+80 p.

This report contains the proceedings of a symposium on motion sickness held at the Wright-Patterson Air Force Base, Ohio, in March 1960. Pertinent papers are abstracted separately, see items no. 1049, 1886, 1894, 1895.

70
Zimkin, N. V.
CONFERENCE ON ADAPTATION, TRAINING AND OTHER METHODS OF INCREASING BODY RESISTANCE, 25-28 JANUARY 1961.—Sechenov Physiol. Jour. USSR (Pergamon Press, New York), 47 (7): 1020-1023. Jan. 1962.
English translation of: Konferentsiia po probleme adaptatsii, trenirovki i drugim sposobam povysheniia ustoichivosti organizma, 25-28 ianvaria 1961 g.—Fiziologicheskii zhurnal SSSR (Moskva), 47 (7): 934-937. July 1961. In Russian.

The majority of papers were concerned with the discovery of adaptation mechanisms and measures for enhancing the organism's resistance to unfavorable agents (physical training, drugs, etc.). Non-specific increase in resistance via non-specific adaptation mechanisms was obtained after administration of Dibazol, "Zhen'shen'", Eleutherococcus, vitamin B_{12}, ascorbic acid, Proserine, eserine, or cortisone. Various experiments were reported where these agents alone or in combination raised the tolerance to hypoxia, hypothermia, hyperthermia, and acceleration in the animal organism. A number of reports dealt with increased resistance resulting from regular exposure to hypoxia. Preliminary adaptation of rats to hypoxia increased their resistance to hypothermia, burn sequelae, and hyperthermia. Hemispherectomy affected hypoxia tolerance differentially in rats and dogs. Other reports described research on the organism's adaptation to ambient heat or cold, the importance of muscular work in increasing non-specific resistance, research on fatigue, development of resistance to drugs by cancer cells, and neural adaptation.

f. Organizational and Administrative Aspects

71
Alt, F.
MANAGEMENT RESPONSIBILITIES IN BIO-MEDICAL ENGINEERING.—Bio-medical Purview, 2: 31-35. 1962.

The manager of a bio-medical engineering organization is charged with an operation which has certain uncommon characteristics: (1) It is an interdisciplinary field of endeavor embracing both the physical and the life sciences. (2) The field encompasses a wide variety of specialties, both in its engineering aspects (electronics, mechanics, optics, fluid dynamics, radiation, thermodynamics, etc.) and in its biological aspects (physiology, neurophysiology, anatomy, biochemistry, surgery, pharmacology, psychology, etc.). (3) Work projects are for the most part non-standard and non-repetitive. (4) Many projects require continuous and close contact between the members of the engineering staff and the bio-medical researcher. All of these characteristics will influence the manager's decisions, particularly in these areas of managerial responsibility: staffing of the engineering organization, training the members of the staff, assigning of projects to individuals or groups of engineers, organizing the staff by fields of specialization, arranging frictionless flow of communication among the staff members as well as between staff members and outside medical scientists and, finally, the evaluation of the organization's output. (From the author's summary)

72
Ambrosini, A.
[LAW INVADES THE SKY] Il diritto invade i cieli.—Ulisse (Firenze), 7: 114-122. June 1962. In Italian.

Legal aspects of outer space and space flight are discussed, with particular reference to the role the United Nations have played and should play in their formulation.

g. Research and Research Methods

73
Armstrong, N. A.,
and E. C. Holleman
A REVIEW OF IN-FLIGHT SIMULATION PERTINENT TO PILOTED SPACE VEHICLES.—North Atlantic

Treaty Organization. Advisory Group for Aeronautical Research and Development, Report no. 403, July 1962. iv+19 p.

The environment of actual flight may be used to simulate many phases of manned space exploration. A number of simulations using conventional, modified, and specially built aircraft are discussed in relation to the portion of space flight to which they are generally applicable, that is the launch, orbital, entry, or the landing-approach phase. Inasmuch as this report is a survey, only the scope of the investigations is indicated; no detailed descriptions of, or conclusions from, the research programs are given. (From the authors' abstract)

74
Armstrong, N. A.,
J. A. Walker, F. S. Petersen, and R. M. White
THE X-15 FLIGHT PROGRAM. —— In: Proceedings of the 2nd National conference on the peaceful uses of space, p. 263-271. Washington, D. C.: National Aeronautics and Space Administration, 1962.

The philosophy, concept of operation, and possible future uses of the X-15 flight program are presented. This program has been operating for 15 years investigating flight and uncovering problems and solutions bringing us closer to space flight with each advance. It is thought that the original objectives of the program will be fulfilled by late fall or early winter in 1962. At that time it is expected that the X-15 aircraft will become very useful as a flying laboratory, or testbed, for aerospace scientific experiments. Some of the studies might include: (1) gathering data in the little-explored region between altitudes of 50 and 100 miles, (2) developing navigational equipment for spacecraft, (3) determining precisely atmospheric density at extreme altitude, (4) measuring the quantity and size of micrometeorites in near space, and (5) determining the intensity of ultraviolet and infrared rays in near space.

75
Baranovskaia, I. V.,
and A. A. Giurdzhian.
[CONTAINERS FOR BIOLOGICAL OBJECTS IN SPACECRAFT EXPERIMENTS] Konteinery dlia nekotorykh biologicheskikh ob"ektov, ispol'zuemykh v eksperimentakh na kosmicheskikh korabliakh.—Problemy kosmicheskoi biologii (Moskva), 1: 405-407. 1962. In Russian, with English summary (p. 407).

Plexiglass containers are described especially designed for use in space experiments: a cylindrical container for plants, a pyramidal container for Drosophila, and a cuboidal one for seeds. Containers used for actinomycetes and algae are in the shape of test tubes. A photograph showing these containers is enclosed.

76
Baranovskaia, I. V.,
and A. A. Giurdzhian
[METHODS OF INSURING PROLONGED SPACE FLIGHTS OF MICE] Obespechenie uslovii dlia prodolzhitel'nogo poleta myshei na kosmicheskom korable-sputnike.—Problemy kosmicheskoi biologii (Moskva), 1: 408-411. 1962. In Russian, with English summary (p. 411).

The container described in this paper, especially designed to house mice in orbital flight, is made of wire mesh and measures 170 x 120 x 120 mm. The food is located in tubes placed along the container walls. Water from a water tank is supplied by a wick. Containers of this type were used in Sputnik-2 as well as in subsequent orbital flights. Two pictures of the containers are included.

77
Burns, N. M.,
R. M. Chambers, and E. Hendler
THE DECADE AHEAD.—In: Unusual environments and human behavior, p. 419-426. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

The current knowledge of man's adaptation to unusual environments is considered meager when compared with what remains to be known and suggestions on the direction research should take during the next decade are offered. These suggestions include more complete definitions of "performance tolerance limit" and "physiological tolerance limits", and interaction of various stresses. Some social problems brought about by the rapid advance of space science are considered, such as man's role in the expanded universe and the public's image of the people considered best qualified to serve in the government since such large sums of money are spent on space science.

78
Carter, E. T.,
and C. E. Billings
NEEDED: SPECIALISTS IN AEROSPACE MEDICINE. I. RESEARCH AND DEVELOPMENT. —— New Physician, 12 (2): 63-67. Feb. 1963.

This is the first of a series of three papers describing the prerequisites, activities, and opportunities in various phases of aerospace medicine. The characteristics of the work, kinds of problems involved, specific studies and clinical applications, and anticipated questions with answers regarding careers in the human factors or human engineering branch of aerospace medicine are given in this initial presentation. The recent emphasis on human factors research provides unlimited opportunity at present for specially trained aerospace medical specialists.

79
Connor, J. A.
SPACE MEDICINE SUPPORT OF MANNED SPACE FLIGHT.—Jour. Saint Barnabas Med. Center, 1 (5): 175-181. Feb. 1963.

All biological and medical risks of space flight and of lunar landing must be reduced to the lowest possible level. To achieve this, the operational medical research program for manned space flight has the following general objectives: (1) to insure the safety, reliability, and effective performance of flight and ground operations personnel during the preparation and conduct of manned flight missions; (2) to devise and conduct a development, test, and evaluation program to acquire the knowledge and equipment necessary to flight missions; (3) to insure that flights are so equipped that biomedical data may be recorded and transmitted; and (4) to provide for the analysis of data, their application to the manned space flight projects, and their communication to the scientific and technical community. The program designed to accomplish these objectives and requirements consists of seven major technical problem areas, identified as physiological stresses, radiation protection, life support systems, flight crew performance, bioinstrumentation, flight crew medical requirements, and medical operations support.

80
Faget, M. A.
FROM MERCURY TO MARS.—Astronautics and Aerospace Eng., 1 (1): 24-28. Feb. 1963

The attainment of orderly progress in the National Aeronautics and Space Administration space exploration program is discussed. Projects of the program already in operation (Mercury, Gemini, Apollo) as well as possible future ones (orbital space station, lunar base, interplanetary spaceship) are included. To get the best progress, planners of future programs and projects should: (1) plan pointed, specific, and orderly programs that provide useful short-term knowledge and lead logically into the next longer term step; (2) insure that estimates of near-future progress are not lowered; (3) be prepared to make less progress than estimated in the early phases of a program; (4) be prepared to encounter otherwise unforeseen advances which will speed progress in later stages of a program; and (5) plan new programs with enough flexibility to accept breakthroughs and advances in the state of the art. Possible future mission requirements are discussed as they relate to today's research and development efforts.

81
Fedorov, E. K.
THE DECISIVE STEP IN THE CONQUEST OF COSMIC SPACE. —— Science and Culture (Calcutta), 28 (1): 11-14. Jan. 1962.

Soviet space efforts preparatory to manned space flight included studies dealing with: (1) the conditions encountered during space flight (accelerations, temperature changes, weightlessness, radiations) and means of protecting the astronaut from their effects; (2) providing normal living conditions in the space cabin; and (3) medical selection techniques and training format for astronauts. The system devised for the constant medical supervision of both the pilot's health and working capacity in all stages of flight is discussed. Y. A. Gagarin's orbital flight (April 12, 1961) is briefly mentioned.

82
Gerathewohl, S. J.,
and B. E. Gernandt
PHYSIOLOGICAL AND BEHAVIORAL SCIENCES. —— In: Proceedings of the NASA-University conference on the science and technology of space exploration, vol. 1, p. 399-413. Washington, D. C.: National Aeronautics and Space Administration, Dec. 1962.

Various efforts by the National Aeronautics and Space Administration to obtain data in the life sciences are presented. These data are needed so that the engineer will be able to produce conditions to accommodate man in space or to provide systems for his protection. The following areas of investigation are included: (1) studies of acceleration stress, (2) physiology of men under confined conditions, (3) Project Mercury physiological studies, (4) life support, (5) neurophysiology, (6) behavioral studies, (7) pilot control of aerospace craft, and (8) astronaut performance. (43 references)

83
Gilruth, R. R.
PROJECTS MERCURY AND GEMINI. —— In: Proceedings of the 2nd National conference on the peaceful uses of space, p. 129-135. Washington, D. C.: National Aeronautics and Space Administration, 1962.

Project Mercury has provided the initial step upon which our future space flight program is being built. In bringing Mercury (orbital flight) to this stage a large fund of both general and detailed knowledge has been acquired including demonstrations of man's capability and utility in space flight and solutions to basic space problems. Project Gemini (orbital flight of longer duration, with a two-man crew) is in the design and construction phase. It is planned to utilize the lessons learned in Mercury and to provide significant increases over Mercury in space flight duration and maneuverability. Gemini will provide flight experience and technical knowledge that will be applied to Apollo (lunar flight) and to more advanced space flight missions. (From the author's concluding remarks)

84
Glenn, J. H.
ASTRONAUT'S REPORT ON PROJECT MERCURY. —— In: Proceedings of the 2nd National conference on the peaceful uses of space, p. 273-275. Washington, D. C.: National Aeronautics and Space Administration, 1962.

The various activities of the space program are involved in obtaining the tools and basic information needed to carry out further space exploration. They include the balloon flights, cosmic ray studies, high altitude Strato-Lab flights, the X-15 studies, the control studies for departing and re-entering the atmosphere, and the suborbital and orbital flights. All of these are essential in completing the big jigsaw pattern that makes the whole picture. Man's great contributions are in the areas of reliability and adaptability. These are discussed as they relate to the extent that automatic and semiautomatic systems will be used in future flights and in mission planning.

85
Green, C. D.
BIOMEDICAL CAPSULES.—In: Physiology of man in space, p. 257-285. Ed. by J. H. U. Brown. New York and London: Academic Press, 1963.

In designing a biomedical capsule or biopack to contain one or more animals during space flight, definite limitations of space, weight, and available power must be met. Next it must be determined whether the data and the animal can be recovered; if not, a system of telemetry must be utilized. Third, the few available days before the firing have a profound effect on biopack designs to date. Several biopack designs and their limitations from the United States and Russia are described in detail. Some of the considerations involved in deciding between a diffusion-type canister or a forced-ventilation type canister for carbon dioxide and water vapor absorption are delineated. Three principles of successful biopack design are discussed: (1) the need for a unitized or self-contained package; (2) simplicity of servicing; and (3) ideally, the insertion of the animal at the last possible moment.

86
Gurjian, A.
SYNTHETIC PRINCIPLE IN SPACE FLIGHT PHYSIOLOGY.—In: International Congress of Physiological Sciences, 22 (Leiden, 1962), Proceedings, vol. 1, part 2, p. 911-913. Amsterdam [1963 ?].

The solution of the problem of the effects of space flight involves different biological methods and various biological objects representing the organic world in different stages and lines of development. The influence of factor complexes affecting man has characteristic features which are difficult to predict by studying them in the laboratory. Space-flight data should be compared with laboratory data concerning the effect of separate factors. When considering the effects on organs and organ systems, one should consider the organism as a unity in which all parts are in close interaction. Pavlov's synthetic principle, Orbeli's teaching of the interaction of afferent systems and of the trophic role of the sympathetic nervous system, as well as Bikov's work on the interaction of the cortex and internal organs can contribute greatly to the study of space physiology. Endurance of a prolonged space flight is conditioned by adaptation resources and mechanisms, and by the compensation of functions altered in flight. These mechanisms allow us to foresee the results of different flights and to formulate a rational program and influence certain links of the compensation process (e.g., by drugs).

87
Holmes, B.
MANNED SPACE FLIGHT. — AIBS Bulletin, 12 (5): 56-59. Oct. 1962.

Four National Aeronautics and Space Administration programs: Mercury, one-day missions, Gemini, and Apollo are discussed together with expected problem areas. The final phases of the Mercury program (orbital flight of short duration) are intended to amplify and expand the basic data obtained during the Glenn and Carpenter flights. The one-day missions program will extend the time of weightlessness and allow further assessment of the physiological effects of this phenomenon. This extension is of prime importance since during the lunar mission the astronauts will be weightless for some five days. The Gemini program will extend capability to orbital flight for two men for approximately 10 days. Aims of this program are to develop rendezvous techniques and gain further insight on the effect of prolonged weightlessness. The fourth major program, Project Apollo, will be the logical culmination of the previous three programs. It is aimed at landing men on the Moon and returning them to Earth. The problems raised by these programs are not insurmountable, and many of them can be recognized far enough in advance to perform the research and development necessary to solve them.

88
Lomonaco, T.
[RECENT RESEARCH IN ITALY IN THE FIELD OF AVIATION AND SPACE MEDICINE] Recenti ricerche in Italia nel campo della medicina aeronautica e spaziale.—Rivista di medicina aeronautica e spaziale (Roma), 26 (1): 5-25. Jan.-March 1963. In Italian, with English summary (p. 14-15).

A review is presented of the research conducted at the Centro di Studi e Ricerche di Medicina e Spaziale in Rome. Facilities of the Center are briefly described including high-performance low-pressure chambers, human and animal centrifuges, subgravity tower and axis, and confinement chamber. Investigations are concerned primarily with: (1) the effects of high altitude (hemodynamics of systemic and pulmonary circulation in chronic hypoxia, biochemical and mechanical effects of explosive decompression, possible protective effect of hypoxia against ionizing radiations); (2) development and calibration of psycho-physiological methods for selection of flying personnel and evaluation of respiratory and cardiovascular function; (3) casuistics and statistics of the pathology of flying personnel; (4) effects of various types of accelerations on respiration, circulation, and the labyrinth, pharmacological means of improving body resistance, enzymatic variations in abrupt decelerations; (5) research on the psycho-physiological effects of weightlessness, especially visual and motor coordination, vestibular function, displacement of thoraco-abdominal viscera, and the effect of training; (6) spatial orientation during immersion in water, labyrinthine and cerebellar thresholds of minimal accelerations, and other electrophysiological investigations; and (7) physiology (air purification) and psychology of life in confined environments. (123 references)

89
Low, G. M.
PROJECT APOLLO. — In: Proceedings of the 2nd National conference on the peaceful uses of space, p. 137-145. Washington, D. C.: National Aeronautics and Space Administration, 1962.

Specific accomplishments on Project Apollo since last year's Conference are outlined and its current status is described. Project Apollo's goal is to carry out a manned lunar landing and return at the earliest practicable date. Three methods of accomplishing this mission that are very plausible are described. These are direct approach, earth orbit rendezvous, and lunar orbit rendezvous. Each has its advantages and disadvantages; however, the Earth orbit rendezvous mode has been selected, temporarily, as the primary approach. The final selection of a mode will be based on a detailed technical and operational analysis of all modes. The mission reliability and pilot safety which must be established for Project Apollo are difficult to achieve. Some of the most important reliability factors are outlined and discussed. If proper attention is given to the reliability factors, the goals for this program can be achieved.

90
Mohler, S. R.
CIVIL AEROMEDICAL RESEARCH: RESPONSIBILITIES, AIMS, AND ACCOMPLISHMENTS. — Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Oklahoma. Report no. 62-20, Oct. 1962. 18 p.

Civil aeromedical research conducted by the Aviation Medical Service of the Federal Aviation Agency is concerned primarily with (1) elucidating those mental and physical attributes of civil airmen most vital to the safe operation of present and proposed civil aircraft; (2) providing the civil aviation industry, from the designer to the operator, with adequate information relative to the physiological, psychological and medical characteristics of civil aircrew members, passengers, and ground support personnel; (3) determining the means by which human tissues may be protected from injury during civil aircraft accidents; and (4) developing means by which the effects of aging, drugs, fatigue, hypoxia, toxic substances, and other factors can be measured with respect to their influence on performance by civil airmen. (Author's abstract) (64 references)

91
Niess, O. K.
THE U.S. AIR FORCE PROGRESS IN AEROSPACE MEDICINE.—Military Med., 128 (3): 215-216. March 1963.

As an address delivered to the Korean Aerospace Medical Association in December, 1962, the author speaks of the future needs in space exploration that must be fulfilled by the aerospace physician. Problems in biomedical monitoring and environmental medicine are fields where research will be stressed. But the author notes that medical benefits can be derived from space research and applied to problems still existing on Earth. Social problems inherent in medicine must be met, and American achievements in aerospace medicine must be shared with the rest of the world.

92
PANEL DISCUSSION: "IS THERE A NEED FOR A MANNED SPACE LABORATORY?". — In: Lunar exploration and spacecraft systems, p. 168-201. Ed. by R. Fleisig and others. New York: Plenum Press, 1962.

Various reasons for the establishment of a manned space laboratory were discussed. The role of man in space was debated as to whether he can or cannot be replaced by machines. The following advantages of a manned space laboratory were cited: increasing the knowledge of the universe, discovering more about man's physiology and psychology, learning of new forms of life, and extending man's environment.

93
Reynolds, O. E.
SPACE BIOSCIENCES. — AIBS Bulletin, 12 (5): 49-51. Oct. 1962.

Space experiments can attain a high proportion of success if highly reliable flight systems adapted to the peculiarities of biological experiments are developed and if close integration of experimental biologists with engineers, physicists, and instrumentation experts is obtained. The introductory statement to the biologists' segment of the National Academy of Sciences summer study report is given. Included in this statement is the division of the biologist's tasks in space science into the following three categories: (1) the search for extraterrestrial life; (2) the attempt to put man into space adequately protected from the peculiar hazards of space and sufficiently sustained by a good semblance of his terrestrial environment; and (3) an exploitation of special features of the space environment as unique situations for the general analysis of the organism-environment relationships. The interconnection among these three aspects of space biology is discussed.

94
Rohles, F. H.,
H. H. Reynolds, M. E. Grunzke, and D. N. Farrer
A PERFORMANCE SCHEDULE FOR EXTENDED SPACE FLIGHT WITH THE CHIMPANZEE.— Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6893, Tasks no. 689301 and 689302). Technical Documentary Report no. ARL-TDR-62-14, July 1962. v+11 p.

A performance schedule designed for measuring animal behavior during prolonged orbital flight is described. It samples three of the five task areas required of the human space traveler: visual monitoring, auditory monitoring, and simple motor behavior. Eating and drinking behavior are also included. It is believed that these functions can be measured in the chimpanzee and will produce a reliable extrapolation from animal findings to the human.

95
Rohles, F. H.,
and H. H. Reynolds
A PROPOSED APPROACH TOWARD DETERMINING THE PSYCHOLOGICAL EFFECTS OF PROLONGED MANNED SPACE FLIGHT.—Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6893, Task no. 689302). Technical Documentary Report no. ARL-TDR-62-28, Dec. 1962. iii+5 p.

Orbital space flights are proposed to study the psychophysiological effects of prolonged weightlessness and cosmic radiation. The program presented will use animal subjects and attempt to eliminate weightlessness and cosmic radiation as deterrents to manned space flights of higher altitudes and longer duration. (Authors' abstract)

96
Sisakian, N. M.,
O. G. Gazenko, and A. M. Genin
[PROBLEMS OF COSMIC BIOLOGY] Problemy kosmicheskoi biologii.—Problemy kosmicheskoi biologii (Moskva), 1: 17-26. 1962. In Russian, with English summary (p. 26).

The basic problems of space biology are briefly these: the influence of extraneous cosmic factors on living terrestrial organisms, biological criteria for safe space flights and existence on other planets, and the question of extraterrestrial life forms and life conditions. A variety of methods are possible in the solution of these problems. Space investigations will undoubtedly promote the progress of various branches of science and technology and contribute to the welfare of mankind.

97
UNITED STATES SPACE SCIENCE PROGRAM: REPORT TO COSPAR. —— National Academy of Sciences-National Research Council, Washington, D. C. [Unnumbered report], May 1962. [164] p.

The United States Space Science Program is reviewed including: (1) summaries of activities and results during the period from about April 1961 to April 1962 as well as other previously unreported activities in the first quarter of the year 1961, (2) current plans for 1962, and occasionally somewhat beyond, and (3) actions taken with respect to international exchange of scientific data resulting from rocket and satellite programs and international cooperative space programs. Also included are these appendixes: (a) the atmosphere of Mars and Venus, and science in space; (b) IGY rocket and satellite report; (c) list of journals in which U. S. space research reports are normally reported; and (d) bibliography (of about 916 items) on space sciences.

98
Warren, J. K.
[ASTRONAUTICS AND MEDICINE] Astronautica e medicina. —— Rassegna medica e culturale (Milano), 39 (9): 15-18, 51. Sept. 1962. In Italian.

Results of recent American and Russian research projects and space missions are reviewed concerned with man in space as affected by magnetic fields, solar radiations, gravitational forces, weightlessness, accelerations, decelerations, and psychological factors. Pictures of a space environment simulator and gondola to study disorientation and the effects of accelerative forces are included.

2. BIOLOGY

a. General

99
Parkes, A. S.,
and A. U. Smith
SPACE TRANSPORT OF LIFE IN THE DRIED OR FROZEN STATE.—In: Space research and technology, p. 33-34. Ed. by G. V. E. Thompson, New York and London: Gordon and Breach Science Publishers, 1962.

Modern biological knowledge of the resistance of living organisms to freezing, drying, and lack of oxygen is discussed in the light of some conditions likely to be encountered in space and on the planets. Biologically, there should be no problem in landing spores, seeds, or desiccated organisms in good condition on another planet provided that overheating and irradiation effects could be avoided, and some of the photosynthesizing organisms might become established on Mars. The establishment of earthly animal life on the planets, especially the more complex forms, would require the provision of microclimates in which oxygen tension, humidity, and temperature were controlled. The biological problem of transporting higher forms of life to planets might be solved by a state of suspended animation (anabiosis) in which food, water, and oxygen requirements would be abolished.

b. Closed Ecological Systems

[*Applied aspects under 11-h*]

100
Barron, C. I.
LIFE SUPPORT SYSTEMS IN SPACE FLIGHT.—Med. Arts and Sciences, 16 (2): 51-57. 1962.

Critical areas are identified as related to spaceflight survival in a completely sealed vehicle. Problems identified associated with the chemical environment include the atmosphere, food, water, and toxicology. Of importance biologically is the problem of waste disposal, and among the physical aspects is the need for maintenance of a comfortable temperature, adequate cabin pressure, and proper humidity. Photosynthesis by algae and its use as food are discussed.

101
Breslav, I. S.,
A. G. Zhironkin, A. M. Il'nitskii, E. A. Konza, M. I. Mitiushov, A. D. Nozdrachev, E. N. Salatsinskaia, G. V. Troshikin, and A. M. Shmeleva
[SOME DATA ON THE EFFECT OF A CLOSED ENVIRONMENT ON THE PHYSIOLOGICAL FUNCTIONS OF ANIMALS] Nekotorye dannye o vliianii zamknutoi sredy na fiziologicheskie funktsii zhivotnykh.—Problemy kosmicheskoi biologii (Moskva), 2: 291-302. 1962. In Russian, with English summary (p. 301-2)

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 300-310. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

White mice kept for three to five days in a hermetically sealed environment with an air regeneration system were studied in regard to the following indices: weight fluctuations, food and water consumption, activity rhythm, gas exchange, oxygen consumption, and histology of the thyroid gland. The gas composition within the container was 18-22% O_2, 0.8-2.0% CO_2, and up to 0.10 mg./liter of ammonia, at a relative humidity of 70-90% and air temperature of 19-23° C. Control animals were kept under similar conditions but with a continuous renewal of atmospheric air. The results show no marked change in the physiological condition of the experimental animals as a result of living in a hermetically sealed environment with a normal oxygen content and 2.0% CO_2. Certain changes in both the controls and the experimental animals were considered to be a stress reaction to the transfer to a different environment. However, since these changes were more pronounced in the experimental animals, additional stress factors are hypothesized, e.g., accumulation of volatile metabolites in the air.

102
Golueke, C. G.,
J. W. Brewer, H. K. Gee, and W. J. Oswald
MICROBIOLOGICAL WASTE CONVERSIONS IN CONTROL OF ISOLATED ENVIRONMENTS.—Univ. of California. Sanitary Engineering Research Lab., Coll. of Engineering and School of Public Health, Berkeley (Contract AF 19(604)-6637). Third Annual Report (SERL Report no. 63-6), Feb. 28, 1963. xii+104 p.

This report describes work done on increasing yield and light energy conversion efficiency of algal cultures and the development of an ecological system consisting of mammals (mice), algae, and bacteria contained in a unit, the "Microterella". The system was closed with respect to gas exchange and water, and partially closed with respect to algal nutrient (25 to 45%) and mammalian nutrient (30%). Results show that the Microterella system is directly applicable to man-scale units, and that from 40 to 50 gallons of algal-bacterial culture should meet the gas exchange and water requirements of one man, as well as provide for the treatment and reclamation of his wastes. A mathematical description is given of the gas exchange dynamics of the system. (Authors' abstract)

103
Ingram, W. T.
MICROBIOLOGICAL WASTE TREATMENT PROCESSES IN A CLOSED ECOLOGY. —— New York Univ., N. Y. (Contract AF 33(616)-7837); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 716403). Technical Documentary Report no. AMRL-TDR-62-126, Nov. 1962. ix+182 p.

Wastes treated in a closed ecological system are discussed according to the parameters affecting composition, quantity, and microorganisms expected in the wastes. Conventional waste treatment processes, activated sludge, trickling filters, and anaerobic digestion are discussed. Microbiological considerations including lists of organisms peculiar to each system and combination of systems are presented and discussed. Results of laboratory-scale experiments of conventional systems receiving concentrated waste are evaluated. Using by-products of waste treatment processes (sludge, bacterial bodies) as nutritional supplements for plants, algae, or animals in a nutrient support system for man during an extended space trip is considered. Experimental volume and power requirements are projected to those applicable under space capsule conditions. Limitations imposed on the several systems for extended space travel indicate that solids should be stored and liquids processed by other than microbiological treatment systems for space flights of less than one year. (Author's abstract) (110 references)

104
INVESTIGATION OF SELECTED HIGHER PLANTS AS GAS EXCHANGE MECHANISMS FOR CLOSED ECOLOGICAL SYSTEMS. — Boeing Co. Aero-Space Div., Seattle, Washington (Contract AF 33(616)-7945); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 716403). Technical Documentary Report no. AMRL-TDR-62-127, Sept. 1962. vi+82 p.

The growth of a variety of Angiosperms was evaluated under controlled conditions in low-intensity fluorescent light. Although a large number of species exhibited various abnormalities, three species, *Brassica Chinesis*, *Cichorium endiva*, and *Amaranthus gangeticus*, were able to tolerate the conditions used and to grow normally. Studies of the photosynthetic activity of these plants showed that a great deal of variation is to be expected both under standard conditions of culture and in media containing increased salt concentrations. Studies of photosynthetic activity by the plants in an atmosphere with the nitrogen replaced with argon or helium indicated that these gases had no adverse effects. Analysis of the three plants included estimation of amino acids, carbon, water- and alcohol-soluble carbohydrates, protein, nitrogen, ash, lipid, and vitamins A, C, and E. The results indicate that the roots, stems, and leaves of these three species could provide a valuable nutritional supplement. Feeding of the plants to rabbits demonstrated that no acutely toxic compounds are present. (Author's abstract) (138 references)

105
London, S. A.,
and A. West
GASEOUS EXCHANGE IN A CLOSED ECOLOGICAL SYSTEM.—Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 716403). Technical Documentary Report no. AMRL-TDR-62-139, Dec. 1962. iii+19 p.

A series of experiments was performed to determine the feasibility of using several types of organisms to maintain a gaseous balance in a closed system. The system consisted of: (a) a photosynthetic unit comprised of cells of *Chlorella pyrenoidosa* strain TX 71105, (b) a biological aerobic sewage-digesting unit, (c) a unit containing an ammonia-utilizing fungus, *Linderina pennispora*, and (d) an animal chamber containing a white adult male rat. Although many difficulties were encountered, this bioregenerating unit could be operated under closed conditions for 390 hours. Gas analyses indicated carbon dioxide and oxygen levels can be maintained at desirable levels. Material balance within the system was not attempted. However, nitrogen analysis of the resultant fungal mass showed that data on the basic physiology of the organism are required before such a balance can be attempted seriously. The relationship between mission requirements and the level of biological complexity of a closed ecological system is discussed. (Authors' abstract) (44 references)

106
Newland, R. G.,
and R. W. Price
DESIGN STUDY OF GRAVITY-INDEPENDENT PHOTOSYNTHETIC GAS EXCHANGER.—General Electric Co., Missile and Space Division, Philadelphia, Pa. (Contract AF 33(657)-7410); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 716403). Technical Documentary Report no. AMRL-TDR-63-59, June 1963. iv+54 p.

A Photosynthetic Gas Exchanger System utilizing a strain of *Chlorella vulgaris* algae was designed, fabricated, and tested for periods up to fourteen days. A maximum oxygen evolution of 1.97 liters per day and carbon dioxide absorption of 1.44 liters per day was achieved during the testing. This capability is provided in a completely closed system which can operate at atmospheric pressures between 7.5 psia and 14.7 psia. The design is capable of gravity-independent operation and is adaptable to automatic and semi-automatic operation by regulation of illumination intensity on the algae in response to surrounding chamber oxygen level. The peak power required by the system is 172 watts. The system is mounted on a structure which illustrates a possible subsequent design for flight application. A follow-on program is recommended to perform further development tests to increase the performance of the system and to adapt the system for testing in an orbiting satellite. (From the authors' abstract) (47 references)

107
Popma, D. C.
LIFE SUPPORT FOR LONG-DURATION MISSIONS. —Astronautics and Aerospace Eng., 1 (7): 53-56. Aug. 1963.

Life support systems for manned interplanetary spacecraft for a three-month mission must include the following processes: carbon dioxide removal, oxygen supply, or, if sufficient power is available, oxygen reclamation; water recycling to recover water from urine, washing, and humidity control; and contaminant control. Not included is the food supply. Development of these systems presents problems relative to: (1) proper instrumentation and control with required reliability and economy to permit missions; (2) data on man within the spacecraft to aid in the design and construction of systems; and (3) the numbers expected in terms of pounds per day per man with respect to oxygen uptake, carbon dioxide output, water production, and nutritional balance as considered within zero- or partial g environments within reasonably confined quarters for long periods. Solution of these problems can only be obtained by human experiments in space stations. Included are graphs of a life-support system for a medium-duration mission, environmental control system, water-management system, and combined environmental-control and water management systems.

108
Sabanas, M.
CLOSED ECOLOGICAL LIFE-SUPPORT UNIT FOR PRIMATES.—Univ. of California. Lawrence Radiation Lab. and Space Sciences Lab., Berkeley (Contract W-7405-eng-48). Report no. UCRL-10589, Dec. 10, 1962. vii+17 p.

Design and construction details of a closed ecological life-support unit are presented together with photographs and graphical illustrations. The arrangement is ground-based and is designed to serve as a research tool for physiological studies. The unit consists of a hermetically sealed cabin, regenerable air-purification means, and water and food dispensers. The combination of silica gel and molecular sieve constitutes a regenerable adsorption system for removal of carbon dioxide and moisture. Oxygen is supplied from a pressurized cylinder. The system maintains a primate unrestricted and controls its life-support system automatically. Results of a 25-day test run are reported. A cardiac-pressure simulator is described and illustrated. (From the author's abstract)

109
Semenenko, V. E.,
M. G. Vladimirova, and A. A. Nichiporovich
[SOME PRINCIPLES OF INTENSIFICATION OF PHOTOSYNTHETIC PRODUCTIVITY OF A CULTURE OF UNICELLULAR ALGAE] Nekotorye printsipy intensifikatsii fotosinteticheskoi produktivnosti kul'tury odnokletochnykh vodoroslei.—Problemy kosmicheskoi biologii (Moskva), 2: 326-339. 1962. In Russian, with English summary (p. 339).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 335-348. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The productivity of algae (Chlorella) per unit illuminated area is about the same as that of higher plants, whereas referred to the volume of the leaf plates the photosynthetic productivity of the algae is much smaller. The main problem in their use in cosmic flight is to raise the photosynthetic activity of the algae per unit volume of suspension. Laboratory cultivation of algae and study of their photosynthetic productivity show that photosynthesis and accumulation of biomass can be greatly increased if conditions for high reproduction rates in dense cultures are created. Light is the determining factor for the photosynthetic productivity of dense algal suspensions. When the irradiation is raised from 64.5 kilocalories per liter of suspension per day to 258 kilocalories, the optimal suspension densities yielding maximal photosynthetic productivity shift toward higher values (up to 800-900 million Chlorella cells per ml. suspension) and the daily growth of the biomass and the productivity of photosynthesis in the optimal zone per unit volume suspension are enhanced. Intensification of algal cultures can be more readily achieved if thermophilic forms are used. (Authors' summary, modified)

110
Vladimirova, M. G.,
V. E. Semenenko, and A. A. Nichiporovich
[COMPARATIVE STUDY OF THE PRODUCTIVITY OF VARIOUS FORMS OF UNICELLULAR ALGAE] Sravnitel'noe izuchenie produktivnosti razlichnykh form odnokletochnykh vodoroslei.—Problemy kosmicheskoi biologii (Moskva), 2: 314-325. 1962. In Russian, with English summary (p. 325).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 321-334. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

This study was undertaken in view of the possible use of unicellular green algae as source of food and as photosynthetic gas exchanger in space flight. For intense cultivation strains should be employed which yield a high productivity and a high photosynthetic rate through a broad light range, and which are thermophilic, saline-resistant, capable of prolonged growth under conditions of an intense culture, and are resistant to bacterial contamination. A correct estimate of the productivity of algae can be obtained only under conditions of active growth. A comparative study of approximately 30 forms of various algae, carried out under intense cultivation in the laboratory showed that forms of Chlorella conformed well with the above requirements.

c. Biological Rhythms and Space Time Studies

111
Aschoff, J.,
and R. Wever
[SPONTANEOUS PERIODICITY IN MAN UNDER THE EXCLUSION OF ALL TIME INDICATORS] Spontanperiodik des Menschen bei Ausschluss aller Zeitgeber. — Naturwissenschaften (Berlin), 49 (15): 337-342. Aug. 1962. In German.

In an isolation experiment, nine subjects were confined to a self-contained cellar unit with complete exclusion of all time indicators. Each individual was allowed to set his own rhythm of sleep, activities, meals, etc. Physiological functions were monitored periodically. Subjective feelings were recorded in diary form or, when verbalized, on tape. The total time spent in isolation varied between 8 and 19 days for each subject. Eight subjects exhibited a distinct spontaneous periodicity deviating from that of earth's rotation around its axis. The established circadian rhythm varied between 24.7 to 26.0 hours. Suggestions are offered for further research on the timing, desynchronization, and synchronization of endogenous rhythms in man.

112
Bolles, R. C.,
and J. de Lorge
THE RAT'S ADJUSTMENT TO A-DIURNAL FEEDING CYCLES. — Jour. Compar. and Physiol. Psychol., 55 (5): 760-762. Oct. 1962.

Rats were run for at least 21 days in activity wheels under either 19-, 24-, or 29-hour feeding cycles. The 24-hour rats showed the usual anticipation of their regular feeding hour, but the adiurnal subjects (those run on 19- and 29-hour deprivation cycles) did not. Instead, their activity tended to occur either at a fixed time of day or, in some cases, 24 hours after the last feeding. The results suggest that wheel-running activity is controlled either by external diurnal cues or by a "biological clock" with a natural 24-hour period, but not by stimuli arising from deprivation per se. (Authors' summary, modified)

113
Craik, K. H.,
and T. R. Sarbin
EFFECT OF COVERT ALTERATIONS OF CLOCK RATE UPON TIME ESTIMATIONS AND PERSONAL TEMPO.—Perceptual and Motor Skills, 16 (2): 597-610. April 1963.

The present study investigated the effects of covert alterations of clock rate upon time judgment and personal tempo. The authors found that over a series of corrected time judgments in which the method of verbal estimation was used and in which the clock rate was covertly altered, the time judgments shifted in the direction of the new clock rate, both when the clock rate was increased relative to ordinary clock rate and when it was decreased. In addition, it was found that covert alteration of clock rate has a differential effect upon two measures of personal tempo. When the altered clock rate was faster than ordinary clock rate, the rate of tempo was relatively greater than when the altered clock rate was less than ordinary clock rate. Self-reports of subjects indicated a wide range of awareness of the alteration in clock rate and of correct understanding of the experimental situation. Further uses of the methodology of alterations in clock rate in conjunction with the psychophysical method of adjustment were suggested for investigations of the subjective passage of time. (Authors' summary, modified)

114
Cranston, W. I.,
and W. Brown
DIURNAL VARIATION IN PLASMA VOLUME IN NORMAL AND HYPERTENSIVE SUBJECTS.—Clinical Sci. (London), 25 (1): 107-114. Aug. 1963.

In ten normal subjects plasma volume measured at 4 - 4:15 p.m. was slightly higher than that at 9:15 a.m. The average afternoon value was 103.19% of that in the morning. There was a slight, but insignificant tendency for the afternoon hematocrit to fall, so that the calculated blood volume increased slightly less than the average morning value. Plasma volume variation was found to be unrelated to change of posture.

115
DAY AND NIGHT EXCRETION RATES. — Nutrition Reviews, 20 (1): 13-15. Jan. 1962.

A brief review of studies on diurnal urinary excretion reveals that the rates of chlorides, sodium, potassium, and riboflavin excretion are lower at night than during the day. Creatinine excretion shows no variation. Reversing the hours of sleep and activity produces a reversal in urinary excretory rhythm. Factors regulating the rates of urinary excretion reside within the individual ("internal clock"). Light is one of the more important external factors regulating this internal clock.

116
Dobrokhotov, V. N.
[ON THE IMPORTANCE OF REGULARITIES GOVERNING THE DIURNAL PERIODICITY OF CELLULAR MULTIPLICATION] O znachenii zakonomernostei sutochnoi periodichnosti kletochnogo razmnozheniia.—Vestnik Akademii meditsinskikh nauk SSSR (Moskva), 18 (7): 50-62. 1963. In Russian, English summary (p. 62).

A summary is presented of the research conducted by the Laboratory of Histophysiology of the Institute of Experimental Biology of the Academy of Medical Sciences of the USSR on the periodicity of mitotic cell division in different organs of rats over a twenty-four hour period and their significance in physiological regeneration. Marked diurnal rhythms in the rate of mitoses were uncovered in many so-called stable organs (liver, pancreas, kidneys, adrenals). Sarcolysin affected the rate of mitoses differently in different organs. The effect of sarcolysin on the same organ also varied when it was administered at different times during the day. An adequate evaluation of factors inhibiting or stimulating cell division may be made only after considering the diurnal rhythm of the rate of mitoses in the tissue. (From the author's summary) (46 references)

117
Dziekanowska, D.,
and A. Nowak
[STUDIES ON MITOTIC ACTIVITY CONTROL IN THE WHITE MOUSE. II. DIURNAL VARIATIONS IN THE MITOTIC ACTIVITY OF EPIDERMIS AND INTESTINAL GLANDS AND IN THE LEVEL OF GLYCOGEN] Badania nad regulacją aktywności mitotycznej u myszy białej. II. Dobowe wahania aktywności mitotycznej w naskórku i gruczołach jelitowych oraz dobowa zmienność poziomu glikogenu w wątrobie. — Acta physiologica polonica (Warszawa), 13 (6): 815-821. 1962. In Polish, with English summary (p. 820-821).

A previous experiment demonstrated a diurnal rhythm in the mitotic activity of the corneal epithelium and in the blood glycogen level, the values of which are roughly inversely related. The present investigation attempted to establish a possible diurnal rhythm in the mitotic activity of other tissues and its relation to the liver glycogen level. The mitotic activity was investigated in the epidermis and intestinal glands. As in the corneal epithelium, the highest mitotic frequencies were at 6 a.m. and the lowest frequencies in the evening. Diurnal variations in the glycogen level in the liver were roughly the inverse of those in the blood, corresponding to a certain extent to variations in the mitotic activity. The peaks and troughs of the glycogen curve preceded a little the respective peaks and troughs of the mitoses curve. The results support the hypothesis that carbohydrates supply the energy for mitosis. (Authors' summary, modified)

118
Feller, R. P.,
and R. B. Hale
HUMAN SYMPATHOADRENAL RESPONSIVENESS IN AUTUMN, WINTER, AND SPRING.—School of Aerospace Medicine. Aerospace Medical Division, Brooks Air Force Base, Tex. (Task no. 775801). Technical Documentary Report no. SAM-TDR-63-46, June 1963. iii+3 p.

By use of urinary catecholamine determinations, sympatho-adrenal activity levels were appraised in 231 healthy human subjects over three seasons (autumn, winter, and spring), with the subjects tested at thermoneutrality. Significant variation with season ($P < .01$) was found for epinephrine and norepinephrine output and for the norepinephrine/epinephrine ratio. The latter measure provided the most clear-cut seasonal variation and indicated that sympatho-adrenal activity was lowest in autumn, highest in winter, and at an intermediate level in spring. Norepinephrine appears to be the dominant catecholamine in winter. Smokers had higher epinephrine values than did nonsmokers; and when the factor of anxiety was added, it tended to act as an intensifier, bringing out the change in responsiveness in the cooler seasons. (Authors' abstract)

119
Frank, G. S.,
H. Lange, and R. Pavy
CIRCADIAN CYCLES AND CORRELATIONS AMONG EEG OUTPUT, DISCRIMINATION TESTS, BODY TEMPERATURE, AND OTHER PHYSIOLOGIC FUNCTIONS IN NORMAL MEN [Abstract]. Neurology, 13 (4): 359. April 1963.

A group of young men were tested at ninety-minute intervals for fifty-five hours to obtain information about circadian cycle functions of several biophysiologic activities. Discrimination and reaction to buzzer-light combinations appeared to vary in circadian fashion, with best efficiency (with short period variation) maintained between about 11 a. m. and 11 p. m. and lowest efficiency in the early morning hours between 1 a. m. and 5 a. m. This cycle of discrimination-reaction efficiency correlates well with measures of cerebral electrical output and body temperature obtained. (From the authors' abstract)

120
Hamar, N.
I. Százados, and Gy. Tiszavölgyi
[PHYSIOLOGICAL DATA ON THE PROBLEM OF WORK SHIFT CHANGES] Arbeitsphysiologische Daten zu Fragen des Schichtwechsels.—Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete (Berlin), 9 (5): 345-349. May 1963. In German.

Work performance curves obtained from the morning, afternoon, and night shifts in industry are analyzed with respect to the influence of the biological 24-hour rhythm on the performance, as well as the effects of fatigue engendered by the physical requirements of the job. Two minima of mental performance are noted—one appears in the early afternoon, the other after midnight. It has to be considered that in certain cases the work itself has been shown to create a protective inhibition which shifts the phase relation of the minima of mental performance, giving an opportunity for recovery with subsequent increase in performance toward the end of the shift in spite of the low point in the diurnal rhythm. In the night shift the efficiency curves follow the diurnal rhythm until the end of the shift when the fatigue effects overwhelm the basic diurnal mental performance rhythm. Studies on workers on extended night shifts suggest that a complete adaptation of the diurnal rhythm of mental performance may be impossible to achieve, although this does preclude the adaptation of other rhythmic functions, e.g., the diurnal temperature curve.

121
Hollwich, F.
and S. Tilgner
[THE BEHAVIOR OF THE EOSINOPHIL COUNT AS AN INDICATOR OF THE EFFECTS OF OCULAR LIGHT STIMULATION] Das Verhalten der Eosinophilen-Zahl als Indikator der okularen Lichtreizwirkung.—Klinische Monatsblätter für Augenheilkunde (Stuttgart), 142 (3): 531-540. April 1963. In German, with English summary (p. 538).

In female laboratory mice, the influence of ocular light stimuli on the number of eosinophile granulocytes in the peripheral blood was investigated. Experimental conditions employed were the physiological change of light and dark, white artificial light, and monochromatic light from four spectral areas. Under standardized environmental conditions of light-dark alternation the number of eosinophils in mice is subjected to a 24-hour rhythm of a sinusoidal shape. In comparison to the curve of eosinophils in man, the one in mice reveals a phase shift of 180 degrees and shows maxima between 12 and 13 hours and a minimum at 24 hours. Sixty minutes after an hour's exposure to white artificial light of 1000 lux, seeing, adult female Agnes Bluhm mice showed a pronounced eosinopenia of statistical significance. Blind animals did not develop eosinopenia under the same conditions. Sixty minutes after a two-hour application of monochromatic lights of the wave-lengths 436, 546, 632, or 707 nm. with the same illuminating power there was a significant eosinopenia in each case. The arithmetical means amounted to 60-75% of the control values. With the technique used a correlation between the effect and wave-length could not be established. (28 references)

122
Kirschner, H.
[ANALYSIS OF THE EFFICIENCY OF A "SIMPLE" AND A "COMPOUND" RHYTHM OF MUSCULAR WORK] Analiza efektywnosci "prostego" i

"złozonego" rytmu pracy miesniowej.—Acta physiologica polonica (Warszawa), 14 (2): 187-201. 1963. In Polish, with English summary (p. 200).

Two rhythms of physical work were compared with respect to work efficiency. The experiments involved work on a finger ergograph (11 subjects) and work on a manual ergograph (7 subjects). The simple rhythm was characterized by even repetition of the individual cycles. In the complex rhythm the same number of movements was arranged in series of two in rapid succession. Comparison of the two rhythms considered the amount of work done in corresponding time intervals, the time needed for complete fatigue to develop, the features of the mechanogram and electromyogram, and the differences between the total electric activity of the muscle. The compound rhythm was found to be closer to the optimum under certain conditions of work intensity. The advantages of the compound rhythm grew as the work intensity diminished. Where the efficiency of the compound rhythm was greater, the total electric activity of the operating muscle was lower. A hypothesis is proposed that the physiological mechanism responsible may be of central nervous system origin.

123
Krasil'nikova, N. V.
[ON THE DIURNAL VARIATIONS OF MITOTIC ACTIVITY IN MICE] O sutochnykh izmeneniiakh mitoticheskoi aktivnosti u myshei. —— Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 53 (4): 100-104. April 1962. In Russian, with English summary (p. 103-104).

A study was made of the diurnal variations of the mitotic activity of the intestinal epithelium, salivary glands, pancreas, kidney, epidermis, and corneal epithelium in mice. Changes of the functional activity of these organs were recorded simultaneously. Regular diurnal changes were apparent in the mitotic activity in the different organs tested. A distinct biphasic curve was seen in the number of mitoses in the digestive organs, less pronounced biphasic maxima in the kidney. The second peak of the cellular mitotic activity curve is a function of the feeding routine. The curves of the mitotic activity in the corneal epithelium and the epidermis were monophasic. An inverse relationship exists between the number of dividing cells and the functional activity of the organ.

124
Kurcz, M.
DIURNAL RHYTHMIC CHANGES OF ELECTROLYTES IN THE BLOOD SERUM OF WHITE RATS [Abstract]. —— Acta biologica Academiae scientiarum hungaricae (Budapest), 12 (Suppl. 4): 49. 1962. In English.

Water, dry material content, and sodium, potassium, chlorine, and phosphate concentrations in the sera of rats were determined four times daily, at 6, 12, 18, and 24 hours. Animals were maintained under standard conditions, fed at 6 p.m., and kept in the dark from 6 p.m. to 6 a.m. A diurnal fluctuation of the serum constituents was found. Serum water content was maximal at night and dry-material minimal. Electrolyte concentration in toto was likewise lowest at midnight and highest between noon and 6 p.m. Fluctuation of several electrolytes was not similar, being subject to the smallest diurnal change, while that of phosphate was the largest. No antagonism was observed regarding changes in sodium and potassium. The rate of maximal change in the diurnal fluctuation varied from 5 to 10% in the compounds examined. This change alone was not considered responsible for the diurnal fluctuations of the diuresis and for the quantitative composition of urine. Other changes (plasma volume, blood pressure, diurnal changes of antidiuretic hormone secretion, etc.) play an important role in this phenomenon. (Author's abstract, modified)

125
Lisiewicz, J.,
and Z. Schiffer
[PRELIMINARY THROMBELASTOGRAPHIC STUDIES ON THE DIURNAL RHYTHM OF BLOOD COAGULABILITY IN NORMAL SUBJECTS] Wstępne badania nad 24-godzinnym rytmem krzepliwości krwi u ludzi zdrowych (metodą trombelastograficzną). —— Acta physiologica polonica (Warszawa), 13 (2): 277-284. March-April 1962. In Polish, with English summary (p. 284).

The thromboelastographic method was used to make twelve determinations of blood coagulation time within 24 hours in each of five healthy men while fasting. For two of the men the determinations were repeated also on a day with normal food intake. In the fasting subjects blood coagulability rose in the afternoon, and particularly at night. With normal meals blood coagulability increased but exhibited considerable variations between individual determinations and showed a relatively less conspicuous upward trend at night. (Authors' summary, modified)

126
Markelova, I. V.
[THE DIURNAL RHYTHM OF THE MITOTIC ACTIVITY OF THE EXOCRINE EPITHELIUM OF THE PANCREAS OF THE RAT] Sutochnyi ritm mitoticheskoi aktivnosti ekzokrinnogo epiteliia podzheludochnoi zhelezy krysy. —— Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 53 (6): 74-77. June 1962. In Russian, with English summary (p. 77).

A study of the pancreas of healthy adult male albino rats (weighing 160-180 g.) revealed a 24-hour rhythm of the mitotic activity in the exocrine epithelium. The mitotic coefficient (number of mitoses per 1000 nuclei of the acinous cells) varied in the 48-hour experiment within the range of 0.27 to 1.4%. The curve characterizing the changes of the diurnal mitotic activity had two peaks: one relatively high peak at 10 a.m. (1.4 and 1.17%) and a smaller and less constant evening peak (0.63 and 0.85%).

127
Mödlinger-Odorfer, M.
[HISTOPHYSIOLOGICAL INVESTIGATIONS OF THE DIURNAL RHYTHM IN THE NUCLEUS SUPRAOPTICUS AND NUCLEUS PARAVENTRICULARIS OF THE ALBINO MOUSE] Histophysiologische Tagesrhythmus-Untersuchungen am Nucleus supraopticus und Nucleus paraventricularis der weissen Maus.

—— Endokrinologie (Leipzig), 43 (1/2): 45-60. 1962. In German.

Structural changes which reflect the diurnal rhythm of function were observed in the neurosecretory cells of the supraoptical and paraventricular nuclei in the hypothalamus of the albino mouse. The changes were expressed in the layering of the cytoplasm, the amount of granules stained by Gömöri's chromatohematoxylin-phloxin method, the appearance of vacuoles, and the size of the cell nucleus structure. The author points to certain relationships between the neurosecretory activity of these cells and the diurnal rhythm of the endocrine organs and of the various life processes of the animal.

128
Neuberger, F.,
and R. Schmid
[AUDITORY THRESHOLD AND SYMPATHICOTONIA, THEIR CYCLIC CONCORDANCE AND TEMPORAL COINCIDENCE IN THE 24-HOUR CYCLE] Hörschwelle und Sympathicotonus, ihre cyclische Konkordanz und temporäre Koinzidenz im 24 Std-Rhythmus. —Archiv für Ohren- Nasen- und Kehlkopfheilkunde (Berlin), 179 (3): 237-258. 1962. In German.

Comparison of values obtained from audiometric measurements with values obtained simultaneously from measuring changes in the galvanic skin resistance in the dorsal neck region revealed the following: (1) The auditory threshold is subject to cyclic fluctuations within the diurnal cycle. (2) The maximum and minimum of the auditory threshold coincides with the maximum and minimum tonus of the concordant sympathetic cycle, so that the periodicity of the sensitivity of auditory perception appears as a manifestation of the sympathetic regulation of metabolic changes in the sensory cells. (3) The reciprocal influence of the acoustic sensorium and the sympathicotonus subserve the metabolism of energy, in which the dissimilatory phase (release of energy) is sympathetically regulated. During performance of acoustic work by the sensory cells energy consumption and energy supply are constantly balanced anew with the help of the sympathetic afferents and efferents. (Authors' summary, modified) (34 references)

129
Odorfer, M. M.
HISTOPHYSIOLOGICAL DIURNAL RHYTHM STUDIES ON THE VEGETATIVE GANGLION CELLS OF THE RETINA OF ALBINO RATS [Abstract]. —— Acta biologica Academiae scientiarum hungaricae (Budapest), 12 (Suppl. 4): 48-49. 1962. In English.

Retinal vegetative ganglion cells of rats maintained at a constant temperature under standard conditions of illumination showed well-defined diurnal rhythmic changes. Cells from animals killed at noon contained granules varying in size at the cell periphery and were characterized by thin cytoplasm and naked nuclei, presumably in the phase of restitution. In animals killed between 5 and 6 p.m. the vegetative cells were less granular. Among the granules, many small round vacuoles were seen which appeared to be optically empty. Cellular cytoplasm in animals killed at midnight was foamy, and phloxinophilic droplets varying in size were frequently visible near the nucleus. Cells of animals killed in the morning contained tiny phloxinophilic droplets at the periphery of the cytoplasm, and among these appeared small granules staining with chrome hematoxylin. The diurnal rhythmic changes observed in retinal vegetative ganglion cells resemble those described previously for supraoptic and paraventricular nuclei of mice. (Author's abstract, modified)

130
Ogata, K.,
and T. Sasaki
ON THE CAUSES OF DIURNAL BODY TEMPERATURE RHYTHM IN MAN, WITH REFERENCE TO OBSERVATIONS DURING VOYAGE.—Japanese Jour. Physiol., 13 (1): 84-96. Feb. 1963.

Observations on the possible factors affecting the development of a diurnal temperature pattern were made in persons during a sea voyage from Hamburg, Germany, to Japan. The time of the morning increase in body temperature coincided with the respective local time and less with the respective longitude or the time of sunrise or sunset. During severe vertigo due to seasickness, body temperature increase in the daytime was suppressed markedly but the morning increase hardly disappeared under any circumstances. High ambient temperature during the voyage exerted no influence on the level of the temperature plateau in the daytime, but it delayed the decrease at night. No change in the diurnal fluctuation was observed in the temperature curve taken in a cell 320 m. underground. Based on observations of the daily body temperature pattern during prolonged or inverted daily routine, irregular shift of daily routine for years, and during vertigo induced by medicine, it is reasonable to assume that the mechanism for maintaining the diurnal body temperature rhythm is primarily attributable to the vestibular function. It is presumed that a limit exists to the non-twenty-four-hour schedule of living to which the body temperature rhythm can adjust itself. (Authors' summary, modified)

131
Oswald, I.
SLEEPING AND WAKING: PHYSIOLOGY AND PSYCHOLOGY. —— ix+232 p. Amsterdam: Elsevier Publishing Co., 1962.

This book reviews the current physiological and psychological literature on sleep and wakefulness and attempts to organize the literature in terms of a theory of mental life, based on both experimental findings of modern neurophysiology and psychologic speculations. Chapters deal with the following topics: (1) physiological basis of sleep, (2) sleep and consciousness, (3) the physiological basis of human sleep, (4) the EEG of sleep, (5) the decline of cerebral vigilance, (6) attention and imagery, (7) the borderland, (8) dreams, (9) sleep as a provoked response, (10) some physiological functions, (11) deprivation of sleep, and (12) sleep mechanisms and some clinical conditions. Included are subject and author indexes and 21 pages of references.

132
Peters, R.
[THE FREQUENCY OF MITOSES IN RAT LIVER AS A FUNCTION OF THE TIME OF THE DAY,

THE WEIGHT OF THE ANIMAL, AND THE NUTRITION] Die Mitosehäufigkeit in der Rattenleber in Abhängigkeit von der Tageszeit, dem Gewicht der Tiere und der Ernährung. —Zeitschrift für Naturforschung (Tübingen), 17b (3): 164-168. March 1962. In German.

Mitotic activity in rat liver reaches a peak at 8 a.m., then falls till approximately 6 p.m. to rise again after midnight. The diurnal variations of mitotic frequency are more pronounced in the younger rats; however, they can still be observed in rats of 150 g. body weight or over. This diurnal rhythm is not developed in suckling infant rats. Injection of a serum from hepatectomized rats had no effect on the diurnal cycle of mitotic activity. In starvation the number of mitoses falls rapidly.

133
RHYTHMIC FUNCTIONS IN THE LIVING SYSTEM. — Ed. by W. W. Wolf. Annals New York Acad. Sci., 98 (4): 753-1326. Oct. 30, 1962.

This is a collection of papers presented at a conference held in New York, November 8-11, 1961. Basic consideration in the study of rhythms is given to such topics as extrinsic rhythmicality, adaptive analog models for biological rhythms, telemetering techniques for periodicity studies, etc. Discussion is presented on the periodicity, apparently inexplicable, of the irregularities in the reactions to pharmaceutical, physical, chemical, enzymatic, and psychological agents. Day-night cycling in atmospheric flight, space flight, and on other celestial bodies, and the periodic desynchronization of humans under outer-space conditions are described. Consideration is also given to Wilder's Law of Initial Values (basimetric approach) in relation to biological rhythms.

134
Rohles, F. H.,
H. H. Reynolds, and M. E. Grunzke
A 30-DAY STUDY OF CHIMPANZEE PERFORMANCE ON A SELF-PACED TASK FOR FOOD AND WATER.—Aerospace Medical Division. Aeromedical Research Lab. (6570th), Holloman Air Force Base, New Mexico (Project no. 6893, Task no. 689301 and 689302). Technical Documentary Report no. ARL-TDR-63-15, May 1963. iv+9 p.

Three chimpanzees were trained to press a lever 50 times to turn on two lights. If the animal desired food reward, a lever in front of the first light was pressed; and if water was preferred, a lever in front of the second light was pressed. Then each animal was isolated for 30 days and permitted to establish its own work-rest cycle on this performance task which was on continually for the 30-day period. Evidence of circadian rhythms was found with heightened activity occurring at 0700 in the morning and lower activity at 1800 in the afternoon. None of the subjects showed any marked physical effects following the experiment. (Authors' abstract)

135
Rohles, F. H.,
H. H. Reynolds, and Carroll Brown
DIURNAL TEMPERATURE CHANGES IN A CHIMPANZEE DURING A 14-DAY RESTRAINT TEST.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6893, Task no. 689302). Technical Documentary Report no. ARL-TDR-63-2, Jan. 1963. iv+9 p.

This report is a supplement to a previously published study entitled, "A Laboratory Model for a 14-Day Orbital Flight with a Chimpanzee". By more detailed analysis of the skin temperature data during the first 6 days of the test, it was found in 5 of the 6 days that mean skin temperatures obtained between midnight and 7:45 a,m. (Period A) were statistically different from those obtained between 8:00 a.m. and 3:45 p.m. (Period B) and between 4:00 p.m. and 11:45 p.m. (Period C), and that means between Periods B and C were also statistically different. (Authors' abstract)

136
Semagin, V. N.
THE SLEEP OF MAN IN ARCTIC REGIONS.—Sechenov Physiol. Jour. USSR (Pergamon Press, New York), 47 (8): 1037-1048. Feb. 1962

English translation of: 0 sne liudei v arktike.—Fiziologicheskii zhurnal SSSR (Moskva), 47 (8): 950-957. Aug. 1961. In Russian.

Diurnal actograms were recorded once a month for a year of 92 subjects mainly from the temperate zones who attended school in the Murmansk region. Also, in view of the strictly regimented life at the school, similar data were gathered from convalescents in Murmansk therapeutic institutions who were not subjected to the same routine. It was concluded that polar day and polar night did not produce any important changes in the diurnal sleep-waking rhythm of healthy subjects or convalescents. Patients took longer to fall asleep at night during the polar day.

137
Vaugien, L.,
and M. Vaugien
[ON THE FEEDING BEHAVIOR OF THE DOMESTIC SPARROW EXPOSED TO NATURAL LIGHT OR TO COMPLETE DARKNESS: DARKNESS REVEALS A PHYSIOLOGICAL CYCLE NEAR 24 HOURS] Sur le comportement alimentaire du moineau domestique séjournant à la lumière naturelle ou à l'obscurité complète: l'obscuration révèle un cycle physiologique proche de 24 h.—Comptes rendus de l'Académie des sciences (Paris), 254 (25): 4357-4359. June 18, 1962. In French.

The daily feeding period of domestic sparrows exposed to natural light is related to the length of the day, and to the environmental illumination. This feeding period during brightness begins at sunrise and ends about a half hour before sunset. It is somewhat shorter during darkness. Sparrows kept in darkness eat for 13 to 14 consecutive hours, ceasing to eat for ten hours. The behavior of sparrows deprived of light demonstrates an intrinsic physiological cycle very near 24 hours. This cycle is normally synchronous with the length of the day, rather than the period of eating accompanying a period of light. The existence of cyclic behavior suggests the possibility that the bird has a tendency to spontaneously register time passed.

138
Walser, A.,
H. Lüthy, and H. R. Jenzer
STUDIES ON DIURNAL VARIATION IN THYROID ACTIVITY [Abstract]. —— Acta endocrinologica (Copenhagen), suppl. 67: 149. 1962.

Diurnal variations in thyroid activity were investigated in a group of healthy young men. Variations at significant levels were found for protein-bound iodine with a maximum increase between 7:30 a.m. and 12:30 p.m., then gradually declining throughout the rest of the 24-hour period. The variations are approximately parallel to those in adrenal activity. Iodine-131 uptake by the thyroid gland exhibits a different pattern with the maximum rise between 7:30 p.m. and 11:30 p.m.

139
Watanabe, G. I.,
M. Uematsu, and K. I. Horii
DIPHASIC SEASONAL VARIATION OF THE SERUM PROTEIN-BOUND IODINE LEVEL.—Jour. Clinical Endocrinol. and Metabolism, 23 (4): 383-386. April 1963.

Thirteen healthy adult men and 10 women were subjected to a survey of seasonal variation in the level of serum protein-bound iodine (PBI) for a period of 13 months. Levels of serum PBI in both sexes varied similarly in the form of diphasic seasonal variation, decreasing in severe weather (winter and summer) and, on the contrary, increasing in intermediate mild seasons (spring and fall). The decreased level of serum PBI in inclement seasons might be interpreted to mean more rapid metabolism of the thyroid hormone in peripheral tissues without an immediate increase in the rate of its release from the gland. (Authors' abstract)

140
Zhukov-Verezhnikov, N.,
V. Kop'ev, I. Maiskii, A. Pekhov, G. Tribulev, and V. Iazdovskii
[BIOLOGICAL ASPECTS OF THE THEORY OF RELATIVITY] Biologicheskii aspekt teorii otnositel'nosti.—Aviatsiia i kosmonavtika (Moskva), 1963 (2): 33-35. Feb. 1963. In Russian.

Since higher animals or insects are not suitable objects for the testing of the theory of time dilatation in high-speed flight, microorganisms should be used for this purpose. An already constructed device (AMN-1) could be employed for the preservation of microbial spores and their cultivation for periods of ten or more years during a prolonged space flight. The growth rates of the cultures could be transmitted to Earth by telemetry, and compared with controls. The authors do not consider the effects of such factors as the increase of the atomic mass and cosmic radiation on the growth rates.

141
Zimmermann, W.,
J. Wennemann, and E. Kaiser
[DIURNAL VARIATIONS IN THE URINARY EXCRETION OF 17-KETOSTEROIDS] Tagesschwankungen der 17-Ketosteroidausscheidung im Harn.—Endokrinologie (Leipzig), 43 (5/6): 215-219. Dec. 1962. In German.

Changes in the urinary excretion of 17-ketosteroids were registered over a five-to-eight-day period for five subjects, taking into consideration the time of the day and the urine volume. The results show a diurnal rhythm of 17-ketosteroid excretion subject to individual variations and environmental influences.

e. Biological Orientation and Navigation

142
Cade, C. M.
NAVIGATION–MAN'S DEBT TO THE ANIMALS. —— Discovery (London), 24 (2): 22-27. Feb. 1963.

Navigation systems are described as they exist in bats, porpoises, water beetles, electric eels, warblers, bees, ants, horseshoe crabs, water fleas, pit vipers, horseshoe flies, and mosquitoes. The physical bases of these systems and of man-made counterparts, where applicable, are also presented. Some of these systems have already played an important part in providing inspiration for man's navigation systems; others, though not well understood at present, hold great promise in this field.

f. Extraterrestrial Environment and Life Forms

143
Anders, E.
METEORITIC HYDROCARBONS AND EXTRATERRESTRIAL LIFE.—Annals New York Acad. Sci., 93 (14): 649-664. Aug. 29, 1962. DLC (Q11.N5,93)

A critical analysis is given of previous work which states that extraterrestrial life and biogenic processes exist in the universe. This statement based on the analyses of mass spectrometric studies of hydrocarbons found in the Orgueil meteorite is refuted. The author compares the peak heights of the mass spectra of butter, recent earthy sediments, and hydrocarbons of the Orgueil meteorite, and finds little resemblance in general. Other criticisms concerning changes in the hydrocarbons of the meteorites by radiation, dehydrogenation by sulfur, replication, and nebular formation are pointed out. These criticisms make it impossible to state affirmatively that life exists outside the Earth.

144
Bellamy, F. H.,
and D. A. Wigley
A LIFE COLONY FOR MARTIAN EXPLORATION. —Spaceflight (London), 5 (2): 38-45. March 1963.

A general outline is given for the establishment and maintenance of a space colony on Mars. Basic assumptions used in the plan and data concerning Martian conditions are discussed. The expected conditions in which the station will operate such as the atmosphere, weather, surface, choice of site, and supply maintenance are stated in detail as based on what is now known. Fifteen persons are considered to be adequate personnel for the first trip. Construction of the colony is based on the use of six expansible mylar domes. Within these domes would be concealed workshops, a control center, sick bay, a research laboratory, hydroponic gardens, and living quarters. Aspects of gardening and food production are discussed. A diagram of the over-all station is given.

145
Beller, W.
MARINER TO TEST MARS LIFE THEORIES. — Missiles and Rockets, 10 (16): 31-32. April 16, 1962.

The schedule and plans of the Mariner A, B, and R projects for the fly-by of Venus and Mars are discussed. The theories concerning the properties of life to be found on Mars are reviewed. The types of plants and certain aspects of metabolism of Martian life are discussed, as well as the role of the Mariner projects in the verification of these theories.

146
Bernal, J. D.
IS THERE LIFE ELSEWHERE IN THE UNIVERSE?—Sci. and Culture (Calcutta), 28 (8): 356-357. Aug. 1962.

Claims have been made that small bodies buried in meteorites similar in size and shape to simple algae were actual remains of organisms that evolved on some object in outer space. Some scientists maintain that these are not organic bodies but small concretions of minerals such as iron oxide or sulfur. Others say that the objects are contaminants, terrestrial organisms that entered the meteorites after they fell. Upon analysis the so-called carbonaceous meteorites showed a 10% water content, an unusual fact since no asteroid between Mars and Jupiter is considered large enough to hold liquid water on its surface. It is postulated that the water is beneath the surface, but no one has accepted the idea of an underground origin of life. An alternative hypothesis is that these organisms actually originated on the Earth, were carried to the Moon along with the water stirred up by the attraction when the Moon joined the Earth, and then were knocked off at a later date and returned to Earth.

147
Briggs, M. H.
THE NATURE AND ORIGIN OF METEORITE ORGANIC MATTER.—Sci. and Culture (Calcutta), 28 (8): 357-360. Aug. 1962.

The presence of organic compounds of extraterrestrial origin in some meteorites is now well-established. However, neither the mere presence of these compounds nor their chemical nature is sufficient evidence of a biological origin. The small organic micro-structures of the meteorites, while showing some features in common with microfossils, are probably also abiogenic. Their definite identification, however, presents an extremely complex problem. (Author's conclusions)

148
Briggs, M. H.
BIOLOGICAL PROBLEMS OF METEORITES.—Spaceflight (London), 5 (2): 45-52. March 1963.

A review is presented of the investigations of the detection of extraterrestrial organisms in meteorites dating from the days of Pasteur, and a critical analysis is given of the problems concerned in identifying and proving that the so-called organized elements are of an extraterrestrial origin. Types of meteorites are discussed, and the nature of the carbon contained in the carbonaceous chondrites is discussed as to chemical type and origin. Evidence for calling the organized elements true extraterrestrial microfossils is reviewed, and it is concluded there is no answer as yet to the question. The origin of the Earth's petroleum is discussed in relation to meteorites, and because of the similarity between the hydrocarbons of meteorites and those of terrestrial petroleum, it is thought that meteorites could be a source of our petroleum. (60 references)

149
Cade, C. M.
ARE WE ALONE IN SPACE? — Discovery (London), 24 (4): 27-29, 32-34. April 1963.

Various theories of the origin of life on Earth are reviewed with reference to the possible development of similar life forms on other planets of other solar systems. It is calculated that of all the stars in the galaxy about 4,000 million could have habitable systems of planets. Evidence for the occurrence of planets of these other systems is presented in relationship to the formation of stars and their physical properties such as mass, momentum, and angular velocity. The extraterrestrial origin of life on Earth (panspermia hypothesis) is discussed critically from the moment of a spore's escape from another planet to the arrival on the Earth's surface. Life on Venus, Mars, and other planets is briefly discussed, while speculations conclude that intelligent life does exist in other parts of the universe.

150
Cade, C. M.
COMMUNICATING WITH LIFE IN SPACE.—Discovery (London), 24 (5): 36-41. May 1963.

With the assumption that intelligent life probably exists on hundreds of millions of stars in the Earth's galaxy, the author presents and discusses a method by which people on Earth can communicate with these extraterrestrial beings. The message would consist of a series of pulses and spaces which when arranged in a pictorial manner would form the image of a biped. Methods of transmission such as the optical maser and the use of microwaves are discussed. Problems such as understanding the message, the actual stars to be communicated with, the number of radio wavebands to be used, and the duration of the attempt are commented upon. Artificial planets sent out by other beings would produce infrared radiation which could be detected by the proper equipment on Earth, and it is suggested that some type of detection apparatus be utilized here.

151
Campbell, P. A.
THE ENVIRONMENT OF THE MOON.—Arch. Environmental Health, 6 (6): 724-729. June 1963.

The Moon's environment contains features thought to be extremely hostile to man and his machines. Principal among these is the absence of an atmosphere with inherent protective characteristics such as that found on Earth. Lunar temperature extremes and the rapidity with which they vary as compared with those on Earth are tremendous. The Moon's surface has been suggested by many to have insulating characteristics. Thus, a solution for man's protection would appear to be underground or subsurface dwellings. Such dwellings would offer protection from such dangers as micrometeoritic dust and radiant energies from space which strike the Moon's surface. Lunar expeditions arriving on the Moon will be required, in some manner, to go subsurface as quickly as possible. This will require either effective methods of burrowing or the use of caves or similar structures. Solutions to the problems involved in human lunar habitation are for the greater part logistical. If enough weight and volume could be lifted to the Moon and safely landed at a proper place, many of the problems would be solved. Such a situation in the foreseeable future, however, is overly optimistic. As a consequence, lunar expeditions must use, to every possible extent, the materials at hand. Means by which the latter might be done as well as the possible existence of life on the Moon are discussed.

152
Croome, A.
VENUS AN INFERNO.—Discovery (London), 24 (4): 5. April 1963.

A condensed report is given of the findings of the Mariner II flight to Venus. Aspects of the atmosphere of Venus such as temperature, cloud formation, ionosphere formation, hydrocarbon content, and the greenhouse effect are discussed. The surface temperature, about 800° F., equal on the day-time and night-time sides, appears to rule out life occurring on the planet's surface, but life would still be possible in certain layers of the atmosphere. Methods of gathering the data are described, and the findings are compared to those previously made from Earth concerning the characteristics of the atmosphere and surface.

153
Fesenkov, V. G.
[MARS AND ORGANIC LIFE] Mars i organicheskaia zhizn'.—Priroda (Moskva), 52 (2): 22-26. Feb. 1963. In Russian.

The author reviews currect astrophysical data concerning the Martian environment and reaches the conclusion that no higher plants or animals can exist on Mars. However, existence of lower forms of life such as bacteria is not ruled out. It is concluded that only actual interplanetary probes will provide uncontroversial information on Martian conditions.

154
Fitch, F. W.,
and E. Anders
ORGANIZED ELEMENT: POSSIBLE INDENTIFICATION IN ORGUEIL METEORITE.—Science (Washington), 140 (3571): 1097-1100. June 7, 1963.

Pollen of six species of false ragweed and ragweed were prepared and stained by the Gridley method (Chromic acid followed by Schiff's reagent and aldehyde fuchsin-metanil yellow staining). Upon distortion by this method the pollen grains showed a definite resemblence in size, color, and morphology to the Orgueil meteorite preparation in which the original type-5 organized element was found. This element definitely was stained with the Gridley method. It is not now possible to say that this type of organized element is completely different from known terrestrial life forms.

155
Golomb, S. W.
WHEN IS EXTRA-TERRESTRIAL LIFE INTERESTING ?—Eng. and Science, 26 (5): 15-17. Feb. 1963.

Life is defined as a systems concept which is composed of organisms capable of growth and replication. The different components of the system may differ from one celestial body to another, but this will make it more possible for life to occur elsewhere. So it appears that future astronauts will have to look for other replicating systems based on chemicals other than the nucleic acids. The question of biological contamination of other planets is discussed, but it is thought that the biological contamination of the Earth by extraterrestrial organisms is more serious. If a foreign replicating system were introduced on Earth, and if it proved to be a better competitor for the molecular substrate need for growth and replication, then the nucleic acid system may become extinct. This problem is of considerable danger to life on Earth, and a great deal of thought should be given to it.

156
Gregory, P. H.
IDENTITY OF ORGANIZED ELEMENTS FROM METEORITES. — Nature (London), 194 (4833): 1065. June 16, 1962.

From the publication of illustrations of organized structures from the Orgueil and Ivuna meteorites the author identifies some of the unknown forms. These appear to be similar to ascospores and pollen grains. The author urges that the illustrations be published so that a larger group of specialists can attempt to identify the structures.

157
Heim, A. H.
RADIOISOTOPIC METABOLIC DETECTION OF POSSIBLE MARTIAN LIFE-FORMS.—Proceedings of the Lunar and Planetary Exploration Colloquium, 3 (2): 37-45; discussion, p. 45-46. May 5, 1963.

The feasibility of a radioisotopic biochemical experiment for extraterrestrial life detection has been established. A medium has been developed which supports the evolution of detectable levels of $C^{14}O_2$ by pure cultures of representative bacteria, streptomycetes, fungi, and algae within a period ranging from minutes to several hours. Mixed populations in soils also respond in less than one hour. An instrument weighing 1.5 pounds has been developed and field tested. In operation, a soil sample is obtained by ejection of two 25-foot lengths of adhesive-impregnated string which are reeled back, with collected soil particles, into a culture chamber. Here a radioactive medium is supplied, and a solid-state radiation detector monitors metabolically evolved radioactive gases. Included are representative tables and figures. (Author's abstract)

158
Hibbs, A. R.
THE IMPORTANCE OF MANNED LUNAR EXPLORATION.—Proc. Lunar and Planetary Exploration Colloquium, 3 (2): 87-98. May 5, 1963.

This is an informal discussion dealing with the activities of man on the moon (as opposed to a piece of equipment) for military, scientific, or other purposes. It appears that sending a man to the moon on the first exploratory trips would be of negligible value. He could do little more than an instrument in collecting preliminary data, geological and, possibly, biological samples from the lunar surface and returning them to earth for processing and evaluation. Once this preliminary information on the lunar environment is available, a man or men should go there to make first-hand observations, gather additional data and samples, and conduct experiments that would be too sophisticated for an instrument or automaton. Once the physical hazards of space travel, lunar landings, and extraterrestrial environments are better understood, steps can be taken to set up a base on the moon, using as many of the indigenous lunar resources as possible. Laboratories for basic research in the various scientific disciplines, as well as launch stations for interplanetary travel, could also be constructed. (Author's summary, modified)

159
Horowitz, N. H.
BIOLOGY IN SPACE. — Federation Proceedings, 21 (4, part I): 687-691. July-Aug. 1962.

Biology is involved in the national space program in three principal areas: (1) in the man-in-space effort; (2) in the investigation of the biological effects of the space environment; and (3) in the search for extraterrestrial life. Mars, and possibly Venus, is sufficiently similar to the Earth to provide a test of the idea that life arises wherever conditions exist for the synthesis and evolution of organic compounds. Experiments (ultraviolet and infrared spectroscopy of surface atmospheres, landing vehicle experiments with television photography, microscopy, etc.) currently considered for investigating the biology of Mars are discussed. Sterilization of all spacecraft landing on the Moon or planets and the possibilities of back-contamination are reviewed, along with the evidence for possible life in meteorites.

160
Imshenetskii, A. A.
[POSSIBILITIES AND METHODS OF DETECTION OF EXTRATERRESTRIAL LIFE FORMS] Vozmozhnosti i metody obnaruzhenia zhizni vne zemli.—Problemy kosmicheskoi biologii (Moskva), 1: 137-144. 1962. In Russian, with English summary (p. 144).

Detection of extraterrestrial life forms would have a profound significance upon our understanding of fundamental biological processes. Microorganisms are possibly a most wide-spread form of life due to their great adaptability. Absence of oxygen in itself may not be an obstacle to the existence of life. In view of the possibility that primitive life forms may be spread throughout space, the construction and use of microbial traps may lead to the detection of extraterrestrial life.

161
Imshenetskii, A. A.
[EXOBIOLOGY - A NEW FIELD OF SCIENTIFIC INVESTIGATION] Ekzobiologiia—novaia oblast' nauchnykh issledovanii.—Vestnik Akademii nauk SSSR (Moskva), 32 (11): 58-63. Nov. 1962. In Russian.

The study of exobiology may be approached in two ways: by attempts to detect living forms in space, and by the study of the effects of the space environment on known microorganisms. In the first case a search should be made for heterotrophic microorganisms since they probably have arisen before chemo- or photo-autotrophic organism. Parallel investigations for the detection of precursors of living forms could be very fruitful and throw additional light on the origin of life. In the second case, the laboratory investigations should include studies of effects on microorganisms of such factors as vacuum, low and high temperatures, and ionizing radiations. Since it is possible that there are primitive, as yet unknown forms living on other planets, it is advisable to formulate now detection methods which may contribute to new discoveries.

162
Kaprielyan, S. P.
ENVIRONMENT MASSIVE CHALLENGE IN MLLP. —Aerospace Management, 5 (6): 14-18. June 1962.

Environmental problems confronting the astronauts and their spacecraft on a lunar journey are discussed. Consideration is given to the space devoid of matter as studied by space simulation chambers and instrumented satellites; the hazard constituted by meteoroids and radiations (Van Allen belts, solar rays and flares, cosmic rays); and the unknown terrain of the lunar surface.

163
Lederberg, J.,
and C. Sagan
MICROENVIRONMENTS FOR LIFE ON MARS. — Proc. Nat. Acad. Sci. U. S. A., 48 (9): 1473-1475. Sept. 15, 1962.

Deductions as to the habitability of Mars, of great importance in planning for space explorations, must take account of local variations, as well as the harsh, average features of the planet. For example, substantial moisture may be frozen in the subsoil, moisture and warmth being available through localized geothermal activity. Models of this kind pose specific questions for high-resolution reconnaissance in planetary flyby missions. (Authors' summary)

164
Levin, G. V.,
A. H. Heim, J. R. Clendenning, and M. F. Thompson
"GULLIVER"—A QUEST FOR LIFE ON MARS. — Science (Washington), 138 (3537): 114-121. Oct. 12, 1962.

Two models are described and illustrated of the Gulliver miniature instrument designed to detect life during early probes of Mars. Gulliver, which utilizes a radioisotope technique, detects the evolution of radioactive gases as end products derived from labeled substrates metabolized by microorganisms. The second model of Gulliver was field-tested in a Washington park and found capable of indicating the presence of at least two different organisms. The most difficult problem in preparing the capsule is sterilization to prevent carrying any contaminants to Mars. Great uncertainty about the capsule's fate after it lands is inevitable. It is supposed that a positive response from the test chamber and a negative or significantly lesser response from the control chamber would be strong grounds for concluding that life exists on Mars. Negative results would indicate that microorganisms having a biochemistry similar to those on earth were not present at the time and place of sampling.

165
Mamikunian, G.,
and M. H. Briggs
SOME MICROSTRUCTURES OF COMPLEX MORPHOLOGY OBSERVED IN PREPARATIONS OF CARBONACEOUS CHONDRITES MADE UNDER STERILE CONDITIONS. — Nature (London), 197 (4874): 1245-1248. March 30, 1963.

A pictorial report is given of microstructures found in eight carbonaceous meterorites. The specimens photographed were prepared under sterile conditions. Due to the disagreement among authorities as to the origin of these structures, these microphotographs are published in the hope of giving numerous scientists the opportunity to examine these specimens. The microphotographs are well presented, and magnifications range from 160x to 1000x.

166
Maraldi, U.
[HYPOTHESES CONCERNING THE LIFE CONDITIONS ON OTHER PLANETS] Ipotesi sulle condizioni di vita in altri planeti.—Ulisse (Firenze), 7: 105-113. June 1962. In Italian.

A brief review is given of some hypotheses concerning the life conditions on the Moon and on the planets of the Solar System. Attempts to interpret possible signals originating from extraterrestrial intelligent beings are also discussed.

167
Margaria, R.
ON THE POSSIBLE EXISTENCE OF INTELLIGENT LIVING BEINGS ON OTHER PLANETS. — Rivista di medicina aeronautica e spaziale (Roma), 25 (1): 24-35. Jan.-March 1962. In English.

The probability that in 3 billion years geological, physical, and chemical evolution took place on other planets in the same sequence and intensity as on Earth is infinitely small. The most optimistic hypothesis may consider that living beings exist on other planets; however, such forms of life may be so different from those on Earth as to be inconceivable. Even if intelligent beings inhabited the planets, it would be by coincidence that they lived in the same time cycle as found on Earth. Possible communications with the inhabitants of planets, although appealing to scientists, are unlikely.

168
Mason, B.
ORGANIC MATTER FROM SPACE. — Scient. American, 208 (3): 43-49. March 1963.

A historical review as well as an analysis of more modern work is presented of the study of organic materials and possible life forms found in meteorites of the carbonaceous-chondritic type. A summary of the analyses of various chondrites is given classifying them as to weight, carbon content, water content, and density. Hydrocarbons and other elements found in the earlier analyses are also discussed. The more recent observations of hydrocarbons and the so-called microfossils found in the chondrites are discussed from the viewpoint of the conclusions drawn from these findings. A critical analysis of the evidence and what it means leads the author to conclude that the existence of extraterrestrial life or of remains of such life in the chondrites is very much in doubt. The evidence of the relationship of hydrocarbons to life, the staining reactions of chondritic material, the morphological structure of the microfossils, and the possibilities of terrestrial contamination are discussed.

169
Miczaika, G. R.
SPACE ENVIRONMENT. — In: Space logistics engineering, p. 27-54. Ed. by Kenneth Brown and L. D. Ely. New York: John Wiley and Sons, 1962.

The solar environment which will affect manned and unmanned space flights is discussed in terms of the solar parallax, corona, gravity, radiation, solar constant, and flux. The equilibrium temperature an orbiting vehicle will assume in the solar radiation field in the absence of internal heat control is considered. The effects of low interplanetary gas pressures in space on materials causes design problems. Mention is made of Earth and interplanetary radiation, meteor particles, meteor-particle penetration depths, atoms and ions in interplanetary space, and vehicle protective shields. Included are 16 tables.

170
Miller, S. L.
THE POSSIBILITY OF LIFE ON MARS.—Proceedings of the Lunar and Planetary Exploration Colloquium, 3 (2): 1-5; discussion, p. 6-7. May 5, 1963.

The primitive Earth is believed to have had a reducing atmosphere which was favorable for the evolution of simple organic life. As Mars was formed from the same cosmic dust cloud as the Earth, similar conditions might be expected to have existed on that planet. Laboratory experiments demonstrate that certain basic organic compounds necessary to produce "living" matter can be formed in such a favorable environment. Although these data and the polarization and infrared measurements of the Martian surface are not conclusive evidence, the existence of life on Mars is highly probable. (Author's abstract)

171
Muller, H. J.
LIFE FORMS TO BE EXPECTED ELSEWHERE THAN ON THE EARTH.—Spaceflight (London), 5 (3): 74-85. May 1963.

A review is presented of the theories and facts concerning the problem of the existence of extraterrestrial life. Conditions for the formation of organic compounds on the various planets are discussed, and recent evidence for the existence of Martian life is analyzed. The origin of life on Earth is discussed in relation to what forms can be expected elsewhere. Life systems based on mechanisms other than nucleotide replication are speculated upon. It is thought that on other planets of other solar systems where conditions are favorable for life there is a good chance that intelligent animal life will have been developed. Communication with these intelligent forms is a difficult task for both parties, but it is possible that we are ahead of others and will reach them first.

172
Oparin, A. I.
[LIFE IN THE UNIVERSE] Zhizn' vo vselennoi.—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1963 (1): 3-8. Jan.-Feb. 1963. In Russian, with English summary (p. 8).

Translation: EXTRATERRESTRIAL LIFE. In: Soviet studies in space biology and medicine, p. 1-7. U.S. Department of Commerce, Joint Publications Research Service no. 18,538 (OTS no. 63-21498, $.50), April 4, 1963.

Entering the era of the interplanetary voyages, we must be prepared for a practical study of life beyond the limits of our planet. Our judgments of the possibility of extraterrestrial life and of its concrete forms can be sound only in the light of the study of the general process of the development of matter, an integral part of which is the origin of life. Three main stages of this process can be stated for Earth: (1) the appearance of the most primitive organic substances, (2) their complication, related to polymerization and condensation, and (3) the origin of multimolecular complexes and their transformation into primary living forms. The first stage is common to the most diverse bodies of the galaxy, the second one is more specific. It can be revealed on meteorites and is assumed to exist on the Moon and Mars. The third stage is also not ruled out on other planets of the Earth type. It could have been realized here at the early periods of the evolution of these planets, and life, having once originated, could have developed, adapting itself to severe conditions arising during the subsequent development. (Author's summary, modified)

173
Oparin, A. I.
[LIFE IN THE UNIVERSE] Zhizn' vo vselennoi.—Priroda (Moskva), 52 (2): 14-21. Feb. 1963. In Russian.

The author discusses the possibility of existence of extraterrestrial life from the point of view of known pathways of evolution of organic compounds. No definite conclusions are reached concerning the possibility of life on Mars and Venus; however, the author is hopeful that there is intelligent life somewhere in the universe.

174
Oyama, V. I.
MARS BIOLOGICAL ANAYSIS BY GAS CHROMATOGRAPHY.—Proceedings of the Lunar and Planetary Exploration Colloquium, 3 (2): 29-36; discussion, p. 36. May 5, 1963.

High sensitivity, relative simplicity, ruggedness, and rapid and wide analytical capability are the characteristics which especially qualify the gas chromatograph for analytical problems in space. It is proposed that the soil of the planet Mars be analyzed for organics by a simple adaption of the gas chromatograph. Volatiles produced by the controlled thermal degradation of organic aggregations are passed through a column, and the chromatogram produced (fingerprint) is indicative of their organic composition. The data suggest and some documentation is given to show that fingerprint patterns obtained from biological systems could be used as a basis for differentiating nonliving aggregates from living systems. (Author's abstract)

175
Palik, P.
FURTHER LIFE-FORMS IN THE ORGUEIL METEORITE. —— Nature (London), 194 (4833): 1065. June 16, 1962.

Crushed, sterile, powered material from the Orgueil meteorite revealed under the microscope 6 different filamentous formations which appear similar in form to algae. The various filaments are briefly described, but the author warns that these structures may possibly be indigenous to the meteorite.

176
Pearson, R.
LIFE-FORMS IN CARBONACEOUS CHONDRITES. —— Nature (London), 194 (4833): 1064-1065. June 16, 1962.

A discussion is presented giving a critical analysis of the identification and interpretation of pollen-like structures found by previous workers in meteorites. It is advised that it would be preferable to prove or disprove the explanation that these forms are of an earthly origin before postulating more elaborate theories.

177
Roberts, T. L.,
R. J. Ball, and E. S. Wynne
STUDIES WITH A SIMULATED MARTIAN ENVIRONMENT. BACTERIAL SYNERGISM: PRELIMINARY SYSTEMS.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775302). Technical Documentary Report no. SAM-TDR-62-151, Jan. 1963. iii+4 p.

Simulated Martian environment (atmosphere of nitrogen, argon, carbon dioxide, and 0.01% oxygen at 65 mm. Hg pressure, temperature cycling between -25° and +25° C.) permitted survival of endospores of *Bacillus cereus* but not of the photosynthetic nitrogen-fixing soil bacterium, *Rhodospirillum rubrum*. There was no evidence of a synergistic relationship. Observed increases in colony counts of *B. cereus* appeared to be due to temperature cycling. (Authors' abstract, modified)

178
Sagan, C.
PROSPECTS FOR LUNAR ORGANIC MATTER.—Bull. Virginia Polytechnic Institute, Eng. Experiment Station Series, no. 152, part C, article XVII. 4 p. May 1963.

A discussion is presented of evidence and theories concerning the possibility of indigenous life on the Moon. Evidence indicating the presence of water on the Moon, a critical point in assuming that life exists on the Moon, is examined. It is thought that already the Moon has been contaminated by the impact of the Soviet space vehicle and that much proof has been lost. It is stressed that all future lunar spacecraft be sterilized. Studies should be oriented toward investigations of the lunar subsurface in detecting contamination.

179
Salisbury, F. B.
MARTIAN BIOLOGY. — Science (Washington), 136 (3510): 17-26. April 6, 1962.

The various environmental characteristics of the Martian atmosphere, surface, and position in respect to the Sun are reviewed and compared to the other planets. The surface markings, including the polar caps and canals, show a great change in color and seasonal variation, and they are discussed as to theories explaining the changes. Photographs of the polar caps are reprinted. The theory explaining the surface markings as being caused by living organisms is presented in light of the evidence concerning the yellow dust clouds, polarimeter readings, absorption bands showing carbon-hydrogen bonds, color changes, and intelligence being responsible for certain unexplainable features. Criteria are given for evaluating known life forms as possible types of inhabitants. Mosses, lichens and microorganisms are discussed. The problem of energy cycles is speculated upon, and a system allowing energy production by electron transfer from carbon to oxygen is proposed. Oxygen would be in combination with some element and water would be only in the atmosphere. Carbon dioxide would result from oxidation of some Martian bio-organic substances. (41 references)

180
Soffen, G. A.
SIMPLE VIDICON MICROSCOPY.—Proc. Lunar and Planetary Exploration Colloquium, 3 (2): 47-48. May 5, 1963.

While specimens of the Martian soil may be collected by means of a string probe, there are still problems of enriching the sample, transporting it to a microscope slide and transmitting what actually is observed. A special instrument developed to facilitate the collection and viewing of microbes is described and illustrated. It includes a microscope with an aerosol medium of bacterial transportation. The device is connected to a vacuum pump to bring in a continuous stream of air which contains bacteria. The bacteria become impacted at the focal plane of a lens on a slide. A source of illumination passes through the orifice to the microscope, and the sample may be viewed either directly or with a television camera. (Author's abstract, modified)

181
Spinrad, H.
A SEARCH FOR WATER VAPOR AND TRACE CONSTITUENTS IN THE VENUS ATMOSPHERE. —Icarus, 1 (3): 266-270. Oct. 1962.

The Doppler shift method was used to find water lines near λ8180 which had previously been determined to be present. The upper limit on Venus of the water vapor/atmosphere mixing ratio down to a level of high temperature was about 10^{-5}. Water vapor was deficient at least until the region where pressure was 8 atmospheres. No findings were made of the A band of formaldehyde at λ3567-3515 with high-dispersion spectrograms.

182
Strughold, H.
HOW BIOASTRONAUTICS LOOKS AT THE MOON. — Jour. Mississippi State Med. Assoc., 3 (9): 397-403. Sept. 1962.

To create artificially, as far as possible, an ecological optimum for terrestrial Moon visitors is a challenge to space medicine and bioastronautics. For example, the lunar atmospheric density is less than 10^{-10} of the terrestrial atmosphere. Exposed to this environment, the unprotected human body faces anoxia at zero altitude and symptoms of ebullism. Although the Earth is essentially a dense atmospheric environment with mild radiations, the lunar environment is essentially a radiation-vacuum environment. Lunar surface gravity is about 17% that on Earth, or 1/6 g, and will greatly affect human metabolism, circulation, muscle activity, and blood pressure. A day-night cycle of 27.3 days' duration does not allow time for regulation of the selenonaut's sleep-wakefulness cycle, determined by the internal physiological clock inherited from Earth. The magnetic field intensity is less than 1/400 that on Earth, and full solar illumination (140,000 lux) is immediately felt. Consideration is given also to the problem of vision, photosynthetic regeneration, and macro- and microclimates.

183
Young, R. S.
EXOBIOLOGY. — In: Proceedings of the NASA-University conference on the science and technology of space exploration, vol. 1, p. 423-429. Washington, D. C.: National Aeronautics and Space Administration, Dec. 1962.

Exobiology is concerned with the detection and study of extraterrestrial life, and its impact on the origin and evolution of life on Earth and elsewhere in the universe. Three phases of the exobiology program of the National Aeronautics and Space Administration (NASA) are described and discussed. These include: (1) studies on the chemistry of formation of biologically significant molecules under conditions that may have prevailed on the primitive Earth or some other likely planet; (2) the detection and study of extraterrestrial life, with the first object of study being the planet Mars, although the Moon, Venus, and Jupiter are not without biological significance; and (3) laboratory studies on Earth in which extraterrestrial and primitive environments are simulated. The NASA program requires highly specialized laboratory facilities and personnel, particularly in biology, biochemistry, and organic chemistry. Some of the work is being done in NASA laboratories, in industry, and in universities throughout the country.

g. Origin of Life and Evolution

184
Calvin, M.
COMMUNICATION: FROM MOLECULES TO MARS. — AIBS Bulletin, 12 (5): 29-44. Oct. 1962.

Biochemical evolution on earth and the generation of molecular compounds which may give rise to terrestrial and extraterrestrial organisms are discussed. A definition of a living system is attempted, and materials known to make a living system, time factors and starting material involved, energy sources, initial transformations, polymerization, generation of order and new information, and the development of cellular structure are presented. Various detecting devices for future assessment of organic matter on the Moon, Venus, and Mars are described. In the meantime, meteorite observations serve as a source of such information. Life in other Galactic systems can be explored only statistically. It is suggested that there must be several terrestrial-type planets upon which living systems could have evolved. (75 references)

185
Dodonova, N. IA.,
and A. I. Sidorova
PHOTOSYNTHESIS OF ANIMO ACIDS FROM A MIXTURE OF SIMPLE GASES UNDER THE ACTION OF SHORT-WAVE, ULTRA-VIOLET RADIATION.— Biophysics (Pergamon Press, New York), 6 (2): 164-175. Feb. 1962.

English translation of: Fotosintez aminokislot iz smesi prostykh gazov pod deistviem vakuumnoi ul'trafioletovoi radiatsii.—Biofizika (Moskva), 6 (2): 149-158. 1961. In Russian, with English summary (p. 158).

Studies were made on photolysis with irradiation by a hydrogen lamp of mixtures of natural gases consisting of ammonia, methane, carbon monoxide, and water vapor over liquid water, two-component mixtures of these gases, and liquid water alone. In the methane, ammonia, and water mixture amino acids, hydrazine, and formaldehyde were detected. In the methane, ammonia, water, and carbon monoxide mixture, and the ammonia, water, and carbon monoxide mixture amino acids, formaldehyde, and urea were detected. The assumption is advanced that formaldehyde and urea are intermediate products in the synthesis of the amino acids. Absence of a sensitizing effect of mercury vapors on the reaction was demonstrated. The effective spectral region in the photosynthesis of amino acids in a mixture of methane, ammonia, and water was from 800 to 1450 Å. (Authors' summary, modified)

186
Firsoff, V. A.
AN AMMONIA-BASED LIFE. — Discovery (London), 23 (1): 36-42. Jan. 1962.

The chemical basis of a living system based on ammonia as opposed to water is presented. A discussion is given of ammonia as a solvent, including its physical characteristics, the requirements it fulfills, and a comparison to water. Various reactions including acid-base reactions, substitutions of NH_2 and NH for carbon radicals in acids, ethers, proteins, and nucleic acids are discussed. It is shown that ammono anologues can also produce energy by chemical breakdown without recourse to oxidation, and it appears that a living system based on ammonia is quite feasible.

187
Gilvarry, J. J.,
and A. R. Hochstim
POSSIBLE ROLE OF METEORITES IN THE ORIGIN OF LIFE. — Nature (London), 197 (4867): 624-625. Feb. 9, 1963.

A hypothesis is advanced which assumes that complex organic compounds originated in the Earth's primitive atmosphere, and were transferred to the hydrosphere. It is suggested that, as a meteroid is traveling at high velocity through the primitive atmosphere of hydrogen, methane, ammonia, and water, the temperatures behind the shock wave would produce monatomic and diatomic species of these compounds and some of the more complex products. The reversion to the original chemical composition would be prevented if the meteroid carried through to impinge on the ocean's surface. Here a large cloud of hot water and steam upon rising into the atmosphere (as in an atomic explosion) would engulf the descending remnants of the original wake. This would prevent further reversion, and the fallout would carry the organic material efficiently into the hydrosphere. These suggestions are based on observations made on meteors in air and on observations of atomic explosions.

188
Morrison, P.
CARBONACEOUS "SNOWFLAKES" AND THE ORIGIN OF LIFE. — Science (Washington), 135 (3504): 663-664. Feb. 23, 1962.

An alternative explanation is offered for the occurrence of the organized forms found in some of the carbonaceous chondrites. It is suggested that these forms are not microfossils as previously interpreted by other authors, but that they are organic chemical aggregates intricately organized into snowflake-like structures. A test is suggested for the confirmation of this interpretation.

189
Oró, J.
EXPERIMENTAL ORGANIC COSMOCHEMISTRY: THE FORMATION OF BIOCHEMICAL COMPOUNDS.— Proceedings of the Lunar and Planetary Exploration Colloquium, 3 (2): 9-27; discussion, p. 27-28. May 5, 1963.

Simple combinations of carbon, nitrogen, oxygen, and hydrogen are important constituents of relatively cool star atmospheres, interstellar space, comets, and cold planetary atmospheres. It is proposed that intercombination of these species in protoplanetary bodies leads to the formation of reactive organic compounds which are the precursors of more complex biochemical molecules. Model experiments involving the use of such simple compounds as water, ammonia, hydroxylamine, hydrazine, hydrogen cyanide, formaldehyde, and acetaldehyde have led to the synthesis of hydroxy acids, amino acids, and amino amides, including glycolic acid, lactic acid, glycine, glycinamide, alanine, β-alanine, aspartic acid, valine, and lysine; monosaccharides, including ribose and 2-deoxyribose, purines and pyrimidines, including adenine, guanine and uracil; purine intermediates, including 4-aminoimidazole-5-carboxamide, 4-aminoimidazole-5-carboxamidine, and formic acid; homo- and heteropolypeptides; and other compounds of biological significance. These experiments have been confirmed and extended recently in other laboratories. Included are representative figures and tables. (Author's abstract, modified)

190
Paretsky, D.
THE CHEMICAL BASIS FOR EVOLUTION. — Univ. Kansas Sci. Bull., 42 (suppl.): 81-97. June 28, 1962.

As the development of a self-replicating system is the base of the evolution of relatively permanent, living organisms, a review is presented of some physical properties of living systems. Proteins, enzymes, nucleic acid and coding, and energy systems are discussed. The conditions found on the primitive Earth about 3000 million years ago were moderate temperature, a reducing atmosphere of water vapor, methane, ammonia, and carbon monoxide among others, no free oxygen, and different types of energies including ultraviolet light. The production of organic compounds under these conditions would include formaldehyde, urea, and amino acids among others. The possible mechanisms for producing purine, adenine, and pyrimidines as the bases in nucleic acids are discussed. The origins of the iron porphyrin pigments as an electron transfer system are described in relation to chlorophyll and the release of free oxygen through photosynthesis. Many of the unanswered questions of evolution are posed as guides to further work and understanding of the chemical basis for evolution.

3. GENERAL PHYSIOLOGY

[Environmental effects under 6]

a. General

191
Cliffton, E. E.,
and R. L. Clarke
INDUCTION OF FIBRINOLYSIS BY HYPERVENTILATION WITH OXYGEN AND CARBON DIOXIDE.—Angiology, 14 (6): 285-287. June 1963.

Seven subjects were hyperventilated for 12-20 minutes with 90% oxygen and 10% carbon dioxide by means of the intermittent positive pressure apparatus. Eight subjects received 100% oxygen for 20 minutes using the same apparatus. A significant increase was observed in fibrinolytic activity by inducing hyperventilation, preferably with 100% oxygen, but also with carbon dioxide and oxygen. This activation was greatest when hyperventilation was forced rapidly and with 100% oxygen. In addition, activity persisted for at least one hour, and in three of the four cases for at least two hours. The mechanism of fibrinolytic activation by hyperventilation is not known, but is presumed to be related to changes in pH, carbon dioxide, or oxygen tensions.

192
Duggar, B. C.
THE CENTER OF GRAVITY OF THE HUMAN BODY. —Human Factors, 4 (3): 131-148. June 1962.

This is an evaluative review of the literature concerning the locations of the centers of gravity of the human body and body segments. Data from several sources are compared and the methods and limitations discussed. It is shown that the selection of source and the manner of applying center of gravity data will depend on (1) the accuracy required, (2) anthropometric characteristics of the population under study, and (3) equipment and body positions anticipated. (Author's summary)

193
Friedman, S. M.,
F. A. Sréter, and C. L. Friedman
THE DISTRIBUTION OF WATER, SODIUM, AND POTASSIUM IN THE AGED RAT: A PATTERN OF ADRENAL PREPONDERANCE. —Gerontologia (Basel), 7 (1): 44-52. 1963. In English.

The detailed distribution of water, sodium (Na), and potassium (K) in a large series of old rats 20-25 months of age was compared with that of young rats 5-7 months old. Measurements were made in plasma and in gastrocnemius muscle samples. There was a marked increase in the extracellular space in old rats mostly due to a shift of water from cells to environment. This was accompanied by a marked gain in total Na and a corresponding loss of total K. The gain of Na was predominantly extracellular but also affected cells. The loss of K was entirely cellular. Increase of Na and K in the extracellular space parallel the increase in water so that no real change in plasma concentration occurred. The fall in cell K likewise paralleled the decrease in cell water. By contrast, the gain in cell Na coupled with the loss of cell water produced a sizable increase in cell Na concentration and a marked fall in the transcellular Na concentration gradient. (Authors' summary)

194
Rohracher, H.
[PERMANENT RHYTHMIC MICROMOVEMENTS OF THE BODY IN WARM-BLOODED ANIMALS ("MICROVIBRATION")] Permanente rhythmische Mikrobewegungen des Warmblüter-Organismus ("Mikrovibration"). —Naturwissenschaften (Berlin), 49 (7): 145-150. April 1962. In German.

The bodies of humans and homothermic animals are under continuous rhythmic microvibration with a frequency of 7-13 c.p.s. and an amplitude between 0.5 and 3μ with relaxed musculature. This microvibration is present from birth until death including sleep and anesthesia. Experimental findings suggest permanent alternating muscle contractions as the origin of vibration. Since only homothermic animals manifest microvibrations, the frequency of which changes parallel to changes in body temperature, it is proposed that the body temperature is kept constant by permanent alternating contractions of muscle fibers and regulated by a change in frequency. Microvibrations may also participate in the regulation of visual processes, provide continuous stimulations of the otoliths by keeping the endolymph in motion, and possibly play a role in tissue metabolism.

195
Saiki, H.
[STUDY OF THE PHYSIOLOGICAL EFFECTS OF HIGH-OXYGEN ENVIRONMENTS. I.] Ko-nodo sanso kankyo no seirigaku-teki eikyo ni kansuru kenkyu. I.—Japanese Jour. Aerospace Med. and Psychol. 1 (1). March 1963. In Japanese, with English summary.

Mice of various ages were exposed to pure oxygen atmospheres at various ambient temperatures. Most 4-week-old animals survived 4-8 days, to a maximum of 12 days; their mean survival time was 8.3 days at 10-14° C. and 6.0 days at 27.5-29° C. Some of the 8-week-old mice died in the first two days, their mean survival time being 5.7 days. The brain tissues of the dead mice showed edema of the nerve cells, hydropic degeneration of the oligodendroglia, and slight satellitosis. Administration of ascorbic acid to the 8-week-old mice resulted in fewer deaths before the third day. but all died between the fourth and eighth days: ascorbic acid seemed to be beneficial in the initial stage of oxygen exposure but detrimental in the middle and last stages. When mice in the second half of the experimental course were removed to normal air, dyspneic attacks were observed in half of them. All mice lost weight (4% per day) during exposure to oxygen. Repeated nonanoxic decompression at adequate intervals reduced the effects of oxygen poisoning. (Author's pre-publication abstract, modified)

196
Sréter, F. A.,
and S. M. Friedman
THE RELATION OF WATER, SODIUM, AND POTASSIUM DISTRIBUTION TO WORK PERFORMANCE IN OLD RATS. —— Gerontologia (Basel), 7 (1): 53-61. 1963.

Studies of the rat gastrocnemius stimulated *in situ* have shown that the performance of work is associated with a progressive fall in the transmembrane concentration gradients of both sodium and potassium. In most of the old rats examined, the sodium concentration gradient was depressed even at rest while the potassium gradient was maintained at a near normal level. In these rats the ability to perform work was markedly diminished. In the remainder of the old rats the potassium gradient was depressed in association with an even steeper fall in the sodium gradient. These rats were almost entirely unable to perform work. Authors' summary)

197
Tromp, S. W.
MEDICAL BIOMETEOROLOGY: WEATHER, CLIMATE AND THE LIVING ORGANISM.—991 p. Amsterdam: Elsevier Publishing Company, 1963.

Various chapters of this book on bioclimatology are of particular interest: Thermoregulation (p. 207-255, 233 refs.) reviews the field of temperature regulation; Breathing mechanism (p. 290-302. 87 refs.) is a review of the field of respiration, with sections on hypoxia and hyperoxia; Biological rhythms (p. 369-371, 60 refs.) deals with the manifestations and largely unknown bases of biorhythmicity; Summary of physiological mechanisms involved in meteorotropism (p. 447-457, 54 refs.) deals with meteorotropic diseases and the biological effects of electrostatic and electromagnetic fields. Various sections of the book contributed by other authors are analyzed separately. (4400 references)

198
Young, R. V.,
R. F. Grover, L. O. Lund, and R. W. Virtue
EFFECT OF HYPERVENTILATION, HYPOTHERMIA, AND UREA ON CIRCULATION AND CEREBROSPINAL FLUID PRESSURE IN THE DOG.—Anesthesiology, 24 (3): 313-317. May-June 1963.

Cerebrospinal fluid pressure, cardiac output, arterial and venous pressure, and pulse rate were determined in ten anesthetized, hyperventilated, normothermic dogs who were given urea 1 gram/kilogram of body weight in two divided doses over one hour. These procedures were repeated after a two-week interval in the same dogs under hypothermia at 30° C. Cadiac output was reduced by hypothermia. However, urea administration did not alter the cardiac output at either body temperature. Arterial and venous pressures remained unchanged. Normal cerebrospinal fluid pressure was not lowered by urea, 1 gram/kilogram, when the body temperature was normal. However, under hypothermia, cerebrospinal fluid pressure was significantly reduced by urea 1 gram/kilogram, but not by a dose of 0.33 gram/kilogram. When carbon dioxide accumulation was prevented, urea in a dose of 1 gram/kilogram of body weight produced no circulatory embarrassment in the anesthetized dog whether normothermic or hypothermic. (Authors' summary)

b. Cardiovascular Physiology

199
Agadzhanian, N. A.,
I. T. Akulinichev, K. P. Zazykin, and D. G. Maksimov
[METHOD OF FIXATION OF ELECTRODES FOR ELECTROCARDIOGRAPHIC RECORDINGS DURING MANNED SPACE FLIGHTS] Metodika fiksatsii elektrodov dlia registratsii elektrokardiogrammy vo vremia kosmicheskikh poletov cheloveka—Problemy kosmicheskoi biologii (Moskva), 1: 451-459. 1962. In Russian, with English summary (p. 459).

Experiments have affirmed the fact that silver disk electrodes cause a minimum of irritation. Two methods of electrode fixations were developed: One uses glue to hold the electrode in contact with the subject's skin, the other employs a special harness. The former was used during Gagarin's flight, the latter on Titov's. Diagrams of both electrode types are included.

200
Allen, M. F.,
and D. E. Langdon
COLD PRESSOR TEST: A 20-YEAR FOLLOWUP STUDY OF 123 SUBJECTS.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775501). Technical Documentary Report no. SAM-TDR-62-137, Dec. 1962. iii+5 p.

In 1960 blood pressures were obtained on 106 active and retired military subjects on whom the cold pressor test had been performed in 1940. These blood pressures and the cold pressor index (rise in systolic blood pressure, millimeters of mercury) were analyzed for predictability of future hypertension. The mean index of the 11 who became hypertensive was significantly larger than the mean index of the 51, of comparable age, 35 years and older, who remained normotensive. Statistical association was found between hyperreaction (using a cutting point of 10 mm. Hg) and hypertension; however, the accuracy of prediction is not good. Thus the test as defined is not recommended as a predictor of future hypertension. (Authors' abstract)

201
Babskii, E. B.,
V. L. Karpman, G. V. Sadovskaia, M. I. Tishchenko
[PHYSICO-PHYSIOLOGICAL STUDY OF THE HIGH-FREQUENCY BALLISTOCARDIOGRAM OF A HEALTHY MAN] Fiziko-fiziologicheskoe issledovanie vysokochastotnoi ballistokardiogrammy zdorovogo cheloveka. —— Kardiologiia (Moskva), 2 (1): 44-52. Jan.-Feb. 1962. In Russian, with English summary (p. 52).

The normal time and amplitude standards of the high-frequency ballistocardiogram of displacement are discussed. It was impossible to make a detailed analysis of the duration of the cardiac cycle phases. Under varying conditions of recording the ballistocardiographic waves were in inconstant time relations with the typical waves of the electrocardiogram, phonocardiogram, dynamocardiogram, and sphygmogram of the carotid artery. This is particularly true of the K wave as it is usually recorded. A change in contact between the lower extremities and the ballistocardiographic table influences the duration of certain intervals of the systolic complex, including the duration of the H-K interval. Changes of the oscillation frequency of the human body itself, parallel to the above changes, were found to exist as well. (Authors' summary, modified)

202
Baevskii, R. M.,
and M. M. Osipova
[SELECTION OF LEADS AND ANALYSIS OF ELECTROCARDIOGRAMS OF DOGS] Vybor otvedenii i analiz elektrokardiogramm u sobak —Problemy kosmicheskoi biologii (Moskva), 1: 422-428. 1962. In Russian, with English summary (p. 428).

Twenty dogs were used to obtain 500 electrocardiograms, which were divided into five general structural groups. The authors regard the following leads as the most suitable: 2, 3, CR-1, CR-3, CL-1, CL-3, VF, and VL. It is suggested that in electrocardiographic interpretation time and systolic indices furnish the most important clues while changes in amplitude are of lesser significance. An 18-lead electrocardiogram of a dog is reproduced. Also included is a table showing the structural distribution of electrocardiographic types according to leads, as well as a table listing EEG indices of the dogs.

203
Burt, J. J.,
C. S. Blyth, and H. Rierson
BODY FAT, BLOOD COAGULATION TIME, AND THE HARVARD STEP TEST RECOVERY INDEX. — Research Quarterly, 33 (3): 339-342. Oct. 1962.

Experiments were conducted on 54 healthy male students to determine the relationship between blood coagulation time and fat storage, Harvard Step Test scores, age, height, and weight. No significant relationship was found to exist between clotting time and the selected variables. (From the authors' abstract)

204
Doskow, I.,
and W. Oreschkow
[THE EFFECT OF MECHANIC AND FUNCTIONAL FACTORS ON THE ECG DURING THE VALSALVA EXPERIMENT] Einfluss mechanscheri [sic] und funktioneller Momente auf das EKG beim Valsalvaschen Versuch.—Doklady Bolgarskoi akademii nauk (Sofiia), 15 (2): 227-230. 1962. In German.

The electrocardiographic changes in response to the Valsalva maneuver are due not only to mechanical factors as hypothesized in the literature but are also partly to changes in the reactivity of the autonomic nervous system. Atropine and caffeine abolish a part of these ECG changes. Even in the absence of caffeine and atropine the electrocardiographic reaction shows certain individual differences. Since both caffeine and atropine do not fully suppress the electrocardiographic response in the Valsalva experiment, it is assumed that there is no basic difference between the individual reactivity and the pharmacologic action in that they determine only the degree of changes in the electrocardiographic reaction from a baseline of stable, primarily positional and hemodynamic-respiratory alterations. Changes in the form and the amplitude of the P_2 and P_3 waves in the Valsalva experiment are effected primarily by the altered position of the heart rather than by the heart rate.

205
Ellis, J. P.,
S. M. Cain, and E. W. Williams
RAPID, ACCURATE ANALYSIS OF BLOOD LACTATE.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775801). Technical Documentary Report no. SAM-TDR-63-49, June 1963. iii+8 p.

A method is described for the enzymatic analysis of blood L-lactic acid. The method is based on existing methods, but incorporates certain unique features which permit a rapid and precise analysis of a large number of samples. One of the more important features is the use of a simplified procedure for correcting the problematic drift of the unstable reaction mixture. In addition, conditions for the enzymatic activity were established which facilitate complete oxidation of lactate in 30 to 35 minutes. A comparative analysis of several blood filtrates, using the present method versus a well-known chemical method, as well as recovery analyses using the two methods, established the validity of the present test system. (Authors' abstract)

206
Harlan, W. R.,
R. K. Osborne, and A. Graybiel
A LONGITUDINAL STUDY OF BLOOD PRESSURE. —Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3001, Subtask 2). Report no. 4, Jan. 31, 1962. ii+21 p.

Serial blood pressure determination were analyzed in a group of 785 healthy young men followed over an eighteen-year period. Frequency distribution curves of blood pressure yielded a continuous distribution with a tendency for each individual to maintain his relative ranking in the population durin the period of study. Significant relationships could be demonstrated between interval change in blood pressure and weight gain as well as increase in body mass. The increment of blood pressure during the follow-up period was related to somatotype as determined on initial evaluation. A positive family history of vascular disease was associated with a greater increase in blood pressure. Analysis of the characteristics of groups from the upper and lower ends of the frequency distribution curves confirmed the importance of these factors in influencing blood pressure. (Authors' abstract) (25 references)

207
Harlan, W. R.,
R. K. Osborne, and A. Graybiel
THE PROGNOSTIC VALUE OF THE COLD PRESSOR TEST AND THE BASAL BLOOD PRESSURE BASED ON AN EIGHTEEN-YEAR FOLLOW-UP STUDY.—Naval School of Aviation Medicine, Pensacola, Fla.

(Project no. MR005.13-3001, Subtask 2). Report no. 6, July 1, 1963. i+8 p.

The cold pressor test is evaluated in a prospective study of young normal individuals followed over an eighteen-year period. The cold pressor response did not correlate with subsequent blood pressure, with interval blood pressure increment, or the development of hypertension. An important relationship was found, however, between basal blood pressure recorded prior to the test and blood pressures recorded eighteen years later. (Authors' abstract)

208
Horecký, J.
[CHANGES OF CEREBRAL AND PERIPHERAL CIRCULATION IN OXYGEN HYPERVENTILATION OF THE LUNGS (PRELIMINARY REPORT)] Zmeny mozgovej a perifernej cirkulácie pri kyslíkovej hyperventilácii pl'úc (Predbežná zpráva). — Bratislavské lekárske listy (Bratislava), year 42, vol. 2: 505-515. 1962. In Slovak, with English summary (p. 514-515).

In dogs hyperventilated with oxygen the arteriovenous difference of the oxygen saturation in the brain circulation increased from 19% to 41%; the peripheral circulation showed at the same time an oxygen drop from 30% to 27.5%. The peripheral arterial pressure fell from 136 mm. Hg to 114 mm. Hg; the venous pressure rose from 61 mm. H_2O to 77 mm. H_2O. The increase in the arterio-venous difference in O_2 saturation is due to the slowed circulation in the brain resulting from an increase of cerebrovascular resistance in hyperventilation hypocapnia. The electroencephalogram showed no signs of hypoxia; however, the amplitude was lowered while the beta rhythm was preserved. In spite of the EEG picture, other clinical signs such as disappearance of the ocular reflexes indicate that the slower brain circulation has some functional effects.

209
McGregor, M.,
R. E. Donevan, and N. M. Anderson
INFLUENCE OF CARBON DIOXIDE AND HYPERVENTILATION ON CARDIAC OUTPUT IN MAN. — Jour. Applied Physiol., 17 (6): 933-937. Nov. 1962.

The effect of changes in ventilation and carbon dioxide tension on cardiac output was studied in seven normal human subjects in the supine posture using a dye dilution method. Voluntary hyperventilation of room air with resultant hypocapnia invariably produced an increase in cardiac output (mean, 38 ml. blood/liter increase in ventilation). Voluntary hyperventilation with maintenance of carbon dioxide tension at near normal levels resulted in a smaller increase in cardiac output (mean, 15 ml./liter). Hyperventilation produced by the inhalation of 8.4% carbon dioxide produced no change in cardiac output within the first 2 minutes but an increase thereafter. The response of the cardiac output to hyperventilation is thus largely determined by the carbon dioxide content of the inspirate. The manner in which this takes place is uncertain. The higher cardiac output response at 2 minutes with hypocapnia may be partly the result of respiratory alkalosis. It might also be related to the increase in respiratory mechanical work per liter ventilation associated with the fall in carbon dioxide. The reason for the late rise of cardiac output with hypercapnia is unknown. (Authors' abstract)

210
Marotta, S. F.
ARTERIAL BLOOD FLOW DURING ELEVATED INTRAPULMONARY AND INTRA-ABDOMINAL PRESSURES. — Proc. Soc. Exper. Biol. and Med., 111 (3): 611-615. Dec. 1962.

Anesthetized dogs were subjected to 3-21 mm. Hg of continuous positive-pressure breathing or intra-abdominal pressures. Carotid and femoral arterial blood flow and mean carotid pressure decreased inversely proportional to increasing continuous positive-pressure breathing while femoral pressure remained essentially unaltered. Thus vascular resistance was significantly elevated only in the femoral circulation. In general, since all levels of intra-abdominal pressures were without effect except for the slight depression in femoral flow, the data suggest that elevations in abdominal pressure which occur during continuous positive-pressure breathing do not play a significant role in the restoration of circulatory parameters. (Author's summary)

211
Richman, S. M.,
and D. Littman
SIMULTANEOUS INTRACARDIAC CATHETERIZATION AND BALLISTOCARDIOGRAPHY: CORRELATION OF BALLISTIC PHENOMENA WITH HEMODYNAMIC EVENTS IN LIVING HUMAN BEINGS. —Amer. Jour. Cardiol., 11 (3): 309-318. March 1963.

Ballistocardiography was performed on 35 patients undergoing cardiac catheterization, and the relation of the ballistocardiographic waves to the electrocardiogram and intracardiac pressure curves was observed and tabulated. Of the systolic waves, the H wave reflects the duration of isometric ventricular contraction. It is proportional to the intraventricular pressure developed during isometric contraction. The I wave is due to recoil of the body from ventricular systolic ejection, and the J wave to impact of the pulse and flow waves on the aortic and pulmonary arch vessels. The K wave is thought to be a noncardiac after-vibration. Of the diastolic waves, the initial L wave occurs at the closure of the aortic valve. A smaller secondary L wave, coincident with pulmonic valve closure is also described. During pre-ejection systole and atrial contraction, F-G waves were observed only in records with sinus rhythm and presumed to be atrial in origin.

212
Roston, S.
BLOOD PRESSURE AND THE CARDIOVASCULAR SYSTEM. — Annals New York Acad. Sci., 96 (4): 962-974. March 2, 1962.

A two-chambered model of the human cardiovascular system is physiologically more reasonable than the single-chambered model. The first of the two elastic chambers represents the ascending aorta and the second, the descending aorta. Connecting the two chambers is a rigid passageway that represents the arch of the aorta. Use of the Laplace transform permits realistic representation of the cardiac output. The mathematical expressions for the pressure in each chamber readily lend themselves to specific numerical solution. Use of reasonable values for the system parameters shows that the pressures in the two chambers have no fixed relationship to each other whatsoever. From this theoretical development emerge some conclusions of clinical interest. One of them is that the blood pressure in the arms varies independently of the blood pressure in the aorta. Thus any similarity that may exist in any given instance between brachial blood pressure and blood pressure elsewhere in the body is merely coincidental and not at all obligatory. (Author's summary)

213
Senay, L. C.,
L. D. Prokop, L. Cronau, and A. B. Hertzman
RELATION OF LOCAL SKIN TEMPERATURE AND LOCAL SWEATING TO CUTANEOUS BLOOD FLOW.—Jour. Applied Physiol., 18 (4): 781-785. July 1963.

The relationship of local skin temperature and the onset of sweating to the local cutaneous blood flow was studied in the forearm and calf. The purpose of the investigation was to appraise the possible relation of sweat gland activity to the cutaneous vasodilatation which has been attributed to bradykinin or to intracranial temperatures. The onset of sweating was not marked by any apparently related increases in the rate of cutaneous blood flow. On the contrary, the onset of sweating was followed often by a stabilization or even a decrease in the level of cutaneous blood flow. The relations of the latter to the local skin temperature were complex, particularly in the forearm. There appeared to be additional unidentified influences, possibly vasomotor, operating on the skin vessels during transitional phases in the relation of skin temperature to blood flow. (Authors' abstract)

214
Sobol, B. J.,
S. A. Wanlass, E. B. Joseph, and I. Azarshahy
ALTERATION OF CORONARY BLOOD FLOW IN THE DOG BY INHALATION OF 100 PER CENT OXYGEN. —— Circulation Research, 11 (5): 797-802. Nov. 1962.

The administration of 100% oxygen to the open-chest anesthetized dog resulted in a decrease in coronary blood flow. This occurred whether or not the animal was fully saturated on ambient air, or was in vascular collapse requiring pressor agents for the maintenance of blood pressure. (Authors' summary, modified)

215
Tishchenko, M. I.
[THE SIGNIFICANCE OF THE HUMAN BODY'S OWN VIBRATIONS IN THE FORMATION OF THE BALLISTOCARDIOGRAM] Znachenie sobstvennykh kolebanii tela cheloveka v formirovanii ballistokardiogrammy.—Biofizika (Moskva), 8 (2): 246-252. 1963. In Russian.

Ballistocardiograms (BCG) of 25 subjects were taken under the following conditions: the feet were supported against the footstep of a ballistocardiograph, or were not supported by the footstep, or two rollers (with the diameters of 60 mm. and 150 mm.) were placed under the Achilles tendons. Measurements were made of the ballistocardiographic systole (H-K interval) and the H-I, I-J, and J-K intervals, the length of the K wave along the zero line which is tangential to the crests of the G waves, and the JK/IJ index. The resonance frequency of the human body placed on a hard surface was significantly affected by the support afforded to the lower extremities. When the support was used, the resonance frequency on the average was 6.75 c.p.s. while it was only 4.5 c.p.s. without support, and fell to 3.6 c.p.s. when rollers were used. The length of the intervals I-J, J-K, and H-K was in an inverse proportion to the magnitude of the resonance frequency of the body. Reduction of the resonance frequency increased the JK/IJ index. It is probable that the differences in straight and high-frequency BCG's, as described by some authors, were due to differences in the support methods used for the lower extremities. The dependence of straight and high-frequency intervals on the resonance frequency casts doubts on the interval analysis method. It is therefore doubtful that the BCG division into systolic and diastolic complexes is well founded.

216
Tsao, M. U.
and A. Vadnay
A SYSTEM FOR THE CONTINUOUS MEASUREMENT OF BLOOD pCO_2. —— In: Proceedings of the symposium for biomedical engineering, vol. 2: 307-310. 1962.

The system is based on the transfer of carbon dioxide from the blood across a thin membrane into water of low conductivity. The increase of conductivity due to carbon dioxide is utilized as the expression of carbon dioxide tension level of the blood and is translated into a signal suitable for continuous recording. The design, construction, and operation of the system are described and diagrammed. The continuous measurement of arterial and venous carbon dioxide tensions in the forearm was carried out on normal adults. The changes in venous carbon dioxide tension due to exercise and chilling of the hand were dramatically demonstrated. (Author's abstract, modified)

217
Wade, O. L.,
and J. M. Bishop
CARDIAC OUTPUT AND REGIONAL BLOOD FLOW.—xv+268 p. Oxford: Blackwell Scientific Publications. 1962.

This book reviews the literature dealing with cardiac output and the pattern of distribution of regional blood flow both in normal subjects and in patients with a variety of diseases. Of special interest are the chapters dealing with the measurement of cardiac output in man, cardiac output at rest and during exercise, methods for studying blood flow in the regional circulation, and distribution of the cardiac output in normal subjects at rest and during exercise. Included is a comprehensive bibliography of 35 pages, arranged alphabetically by author, and a subject index.

218
Wasserman, K.,
and J. H. Comroe
A METHOD FOR ESTIMATING INSTANTANEOUS PULMONARY CAPILLARY BLOOD FLOW IN MAN. — Jour. Clinical Investigation, 41 (2): 401-410. Feb. 1962.

The Lee and DuBois method is described for measuring instantaneous pulmonary capillary blood flow in man by nitrous oxide uptake without the use of the body plethysmograph. The method gives reproducible measurements of stroke volume and cardiac output that agree well over a wide range of cardiac outputs with those obtained by the indicator dilution and direct Fick methods. Pulmonary capillary blood flow in man was found to be pulsatile during the cardiac cycle. (Authors' summary, modified)

c. Respiratory Physiology

[*Effects of anoxia under 6-d; Respiratory metabolism under 3-d*]

219
Agostoni, E.
DIAPHRAGM ACTIVITY AND THORACOABDOMINAL MECHANICS DURING POSITIVE PRESSURE BREATHING. — Jour. Applied Physiol., 17 (2): 215-220. March 1962.

The electrical activity of the diaphragm and the mechanical contribution of the thorax and the abdomen through the breathing cycle has been investigated in man during positive pressure breathing (PPB). The electrical activity of the diaphragm persists even at values at which inspiration should be completely passive according to the pressure volume diagram of the thorax and lung. The transdiaphragmatic pressure decreases as the value of PPB increases but is still appreciable at values of PPB at which the inspiration appears to be completely passive by an analysis based on transthoracic pressure measurements alone; the transdiaphragmatic pressure becomes zero only at PPB of about 30 cm. of water. The persistent activity of the diaphragm during PPB is counterbalanced by an activity of the abdominal muscles in excess of that of the expiratory muscles as given by transthoracic pressure measurements. Owing to the persistence of an abdominothoracic pressure gradient, the venous return and therefore the cardiac output should be less reduced than in the case of a passive inspiration. (Author's abstract)

220
Agostoni, E.
DIAPHRAGM ACTIVITY DURING BREATH HOLDING: FACTORS RELATED TO ITS ONSET. — Jour. Applied Physiol., 18 (1): 30-36. Jan. 1963.

The period of breath holding, in most subjects, may be divided into two parts: the first, characterized by voluntary inhibition of respiratory muscles activity; the second, by involuntary respiratory efforts. The standard error (SE) of alveolar carbon dioxide tension (PCO_2) values determined at the onset of diaphragm activity in groups of three similar tests was <0.5 mm. Hg. Arterial PCO_2 in the brain stem at the onset of diaphragm activity was estimated: breathing O_2 the mean values ± SE in three subjects were, respectively, 46.2 ± 0.3, 46.4 ± 0.2, and 50.2 ± 0.2. The onset of diaphragm activity seems not affected by neurogenic factors related to lung volume or respiratory movements. An alveolar PCO_2-PO_2 (oxygen tension) curve at the onset of diaphragm activity was determined. (From the author's summary)

221
Alifanov, V. N.,
M. I. Vakar, A. V. Eremin, and A. E. Ivanov
[THE EFFECT OF RESISTANCE TO INSPIRATION ON BREATHING UNDER INCREASED PRESSURE] Vliianie soprotivleniia vdokhu na dykhanie pod izbytochnym davleniem.—Problemy kosmicheskoi biologii (Moskva), 2: 287-290. 1962. In Russian, with English summary (p. 290).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 297-299. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Another English translation: THE INFLUENCE OF RESISTANCE TO INSPIRATION UPON PRESSURE BREATHING. — Revue de médecine aéronautique (Paris), 1 (3): 17-18. March-April 1962.

Seven healthy young men, 20-33 years old, were employed as subjects in a series of experiments exploring the effect of varied pressure on positive-pressure breathing at sea level and at a simulated altitude of 20 km. A special modification of the oxygen apparatus allowed a reduction of the positive pressure in the inspiratory phase by 25-300 mm. water. The results show that a reduction of positive intrapulmonary pressure in the inspiration phase by more than 50-100 mm. H_2O leads to general functional disturbances. The effect of these variations depends on the magnitude of variations in intrapulmonary pressure and the altitude. Most affected are respiratory functions resulting in a decrease of blood oxygen saturation. Replacement of the oxygen mask by a helmet merely increases the dead space which reduces the tolerance to the variations in intrapulmonary pressure. Electromyograms of the respiratory muscles are a good index of the degree of difficulty in respiration with the use of a breathing apparatus.

222
Ashton, C. H.,
and G. J. R. McHardy
A REBREATHING METHOD FOR MEASURING MIXED VENOUS PCO_2 DURING EXERCISE [Abstract].—Jour. Physiol. (London), 167 (1): 2P-3P. June 1963.

The apparatus allows short periods of rebreathing to be alternated with periods of collection of expired air during exercise on a stationary bicycle. During rebreathing of carbon dioxide-oxygen mixtures from a bag, the fluctuations in the carbon dioxide concentration in the gas sampled from the neck of the bag are observed and recorded with a rapid analyser. This method takes particular account of factors influencing the equilibrium which becomes important during exercise. Rapid mixing of the gas in the lungs and the bag shortens the time needed to reach equilibrium. Close approximation of the carbon dioxide tension in the lung-bag system to that of mixed venous blood also favors rapid equilibration and is achieved by selection of the lowest initial carbon dioxide concentration in the bag which is compatible with obtaining a plateau. Full oxygenation is maintained throughout by using fresh mixtures of carbon dioxide in oxygen for each rebreathing. Simultaneous recording of respiration ensures that the shorter periods of equilibrium occurring during exercise can be correctly recognized. Each rebreathing takes not more than 15 seconds and can be repeated after an interval of 45 seconds. Three or four rebreathings are usually required to determine the mixed venous carbon dioxide tension. (From the authors' abstract)

223
Ayres, S. M., 1963
R. L. Kozam, and D. S. Lukas
THE EFFECTS OF INTERMITTENT POSITIVE PRESSURE BREATHING ON INTRATHORACIC PRESSURE, PULMONARY MECHANICS, AND THE WORK OF BREATHING. — Amer. Rev. Respir. Diseases, 87 (3, part I): 370-379. March 1963.

Intrathoracic pressure during intermittent positive-pressure breathing at identical mask pressure varied widely depending on the degree of relaxation of the subject. In the completely relaxed subject, intrathoracic pressure remained positive in relation to the end-expiratory point throughout inspiration. In contrast to spontaneous breathing, pulmonary compliance varied inversely with flow rate, and inspiratory viscous resistance diminished slightly. In the completely relaxed subject, the work of breathing during inspiration approached zero. (Authors' summary, modified)

224
Barnett, T. B.,
and R. M. Peters
STUDIES ON THE MECHANISM OF OXYGEN-INDUCED HYPOVENTILATION: AN EXPERIMENTAL APPROACH. — Jour. Clinical Investigation, 41 (2): 335-343. Feb. 1962.

Hypoventilation with accompanying hypercapnia was observed when dogs with artificially increased respiratory dead space were allowed to breath 50% oxygen. Decreased ventilation during oxygen breathing did not seem to depend solely on a state of hypoxia or of hypercapnia prior to the period of oxygen breathing. The circumstances under which hypoventilation occurred with oxygen breathing—namely, 15 cc. added dead space per kg. for 3 days—were not associated with a decreased ventilatory response to carbon dioxide attributable to acclimatization; the only change in the response to carbon dioxide was that associated with an increase in the work required to ventilate the alveoli. The importance of increased work of breathing as a factor in the regulation of ventilation is discussed. (Authors' summary) (20 references)

225
Bartlett, R. G.,
and R. A. Hertz
AUTOMATIC ECONOMIC NITROGEN ELIMINATION IN OXYGEN REBREATHING SYSTEMS. — Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. MR005.13-3100, Subtask 8). Report no. 10, Feb. 19, 1962. ii+7 p.

Economic, automatic nitrogen elimination from the body is a necessary adjunct to an acceptable oxygen rebreather system. A new approach to nitrogen elimination has been developed. Economic, periodic nitrogen purging is accomplished with normal breathing and without any manual manipulation or attention by the aviator during the elimination schedule. The purging schedule makes possible the design of a completely automatic self-purging oxygen rebreathing system. (Authors' abstract)

226
Bartlett, R. G.,
N. E. Phillips, and G. Wolski
MAXIMUM VOLUNTARY VENTILATION PREDICTION FROM THE VELOCITY-VOLUME LOOP.— Diseases of the Chest, 43 (4): 382-392. April 1963.

When a maximum voluntary ventilation, maximum velocity-volume loop (MVV V-V loop) is superimposed on a maximum (forced) vital capacity V-V loop, it follows the maximum envelope during the major portion of a breath half cycle until it breaks away abruptly, transects the zero velocity abscissa, and joins the maximum envelope for the other breath half cycle. Because of the relationship of the MVV V-V loop to the maximum V-V loop, it is possible to simulate the MVV V-V loop by erecting perpendiculars at either end of the tidal volume. If this is done for a variety of assumed tidal volumes, MVV V-V loops at a number of breathing frequencies are simulated. By use of the equation Time-V^2/Area, the calculated time for moving each assumed tidal volume in and out of the lungs if found. From the tidal volume and the time necessary for its movement, breathing frequency and MVV are calculated. The "correct" (optimum) placement of the tidal volume on the vital capacity axis is found by use of a family of curves (breathing frequency-limit of inspiration) which are evolved from the maximum V-V loop. The predicted MVV values over a wide range of breathing frequencies calculated from a single maximum V-V loop compare favorably with MVV values obtained with the usual 15-second MVV test. (Authors' summary)

227
Berglund, E.,
G. Birath, J. Bjure, G. Grimby, I. Kjellmer,
L. Sandqvist, and B. Söderholm
SPIROMETRIC STUDIES IN NORMAL SUBJECTS. I. FORCED EXPIROGRAMS IN SUBJECTS BETWEEN 7 AND 70 YEARS OF AGE.—Acta medica scandinavica (Stockholm), 173 (2): 185-191. Feb. 1963.

A total of 296 males and 201 females, 7-70 years of age, were studied. Vital capacity and forced expiratory volume in 1.0 seconds (VC and FEV$_{1.0}$) were plotted against age. Both could be described mathematically as a function of age and height for the whole range. Simplified equations and nomograms for VC and FEV$_{1.0}$ were derived as rectilinear correlations with age and height for the adults. For the FEV percentage, the only significant correlation was found with age, there being a slight decline with increasing age. Included are representative regression equations, graphs, a statistical appendix, and nomograms.

228
Berloco, N.,
F. Caspani, and C. Masserini
[RELATIONSHIP BETWEEN MUSCULAR ACTIVITY AND RESPIRATORY FUNCTION IN HEALTHY SUBJECTS OF DIFFERENT AGES. II. PULMONARY VENTILATION] Rapporti tra attività muscolare e funzione respiratoria nei soggetti sani di differente età. II. La ventilazione polmonare. —— Giornale italiano della tubercolosi e delle malattie del torace (Milano), 16 (3): 105-110. May-June 1962. In Italian.

A lack of diversity, either quantitative or qualitative, was observed in the pulmonary ventilation of healthy subjects of various ages (school age, young, old) performing muscular work under aerobic conditions. In all subjects the ventilation increased proportionally with the increase in the amount of work. In school-age subjects an increase was found in the respiratory frequency which was more pronounced than in the other subjects. In young subjects the increased ventilation was caused by the increase in ventilatory volume. Aged subjects presented a ventilatory behavior intermediate between the two groups. This diversity is related to the various anatomic characteristics of the pulmonary apparatus. Included are various tables and charts.

229
Berloco, N.,
F. Caspani, and C. Masserini
[RELATIONSHIP BETWEEN MUSCULAR ACTIVITY AND RESPIRATORY FUNCTION IN HEALTHY SUBJECTS OF DIFFERENT AGES. III. ENERGY REQUIREMENT OF VENTILATION] Rapporti tra attività muscolare e funzione respiratoria nei soggetti sani di differente età. III. Il rendimento energetico della ventilazione. —— Giornale italiano della tubercolosi e delle malattie del torace (Milano), 16 (3): 111-113. May-June 1962. In Italian.

The energy requirement of ventilation measured in groups of healthy subjects of school, young, or old age performing muscular work indicated that young subjects had the best energy efficiency. This is probably due to the fact that in these subjects the pulmonary ventilation during work is increased by the increase in ventilatory volume rather than by the increase in respiratory frequency. Aged subjects had a higher energy requirement than subjects of school age. Included are various tables and charts.

230
Birath, G.,
I. Kjellmer and L. Sandqvist
SPIROMETRIC STUDIES IN NORMAL SUBJECTS. II. VENTILATORY CAPACITY TESTS IN ADULTS. —Acta medica scandinavica (Stockholm), 173 (2): 193-198. Feb. 1963.

Dynamic lung function studies were performed on 120 healthy men and women, aged 20-65, using a special low-resistance spirometer. Normal values are given for the maximal midexpiratory flow (MMF) and the maximum voluntary ventilation with a fixed frequency of 40 respirations per minute (MVV_{40}). MVV_{40} and the forced expiratory volume in one second show a good correlation with each other but a poorer correlation with MMF.

231
Bishop, B.
ABDOMINAL MUSCLE AND DIAPHRAGM ACTIVITIES AND CAVITY PRESSURES IN PRESSURE BREATHING. —— Jour. Applied Physiol., 18 (1): 37-42. Jan. 1963.

The respiratory contribution of the diaphragm and external oblique abdominal muscle has been assessed by recording from the anesthetized cat the integrated electromyograms during continuous pressure breathing. As the intrapulmonary pressure is progressively reduced from 0 to -12 cm. H_2O, the diaphragm becomes increasingly active until it has no silent period during the respiratory cycle. Concomitantly, any respiratory activity in the abdominal muscle is completely silenced. A hyperactive diaphragm and relaxed abdominal wall can account for the constancy seen in the directly recorded intra-abdominal pressure even though the intrathoracic pressure falls. When the animal is subjected to pressures from 0 to +14 cm. H_2O, the diaphragm is initially inhibited and the abdominal muscle becomes increasingly active. In every animal, on positive pressure the abdominal muscle becomes active during expiration and in 20% of the animals it is also active during inspiration. Active expiration continues throughout the pressure breathing and is sufficient to reverse the breath-by-breath abdominal pressure variations. During negative pressure breathing, respiration is an inspiratory act and only the thorax is subjected to stress. During positive pressure breathing, respiration is an expiratory act and both the thorax and abdomen are subjected to the stress. (Author's abstract)

232
Booth, R. W.,
J. M. Ryan, H. C. Mellett, E. Swiss, and E. Neth
HEMODYNAMIC CHANGES ASSOCIATED WITH THE VALSALVA MANEUVER IN NORMAL MEN AND WOMEN. —— Jour. Lab. and Clinical Med., 59 (2): 275-285. Feb. 1962.

Effects of the Valsalva maneuver were studied in 21 normal adults (10 men and 11 women). Brachial arterial, intraoral, and right atrial pressures were measured and cardiac outputs obtained in all phases of the maneuver by the indicator-dilution technique. Both flow and pressure changes were of greater magnitude in all phases of the maneuver in women than in men. Indicator-dilution curves seem to be "made up" between 5 and 15 seconds after injection. The gross systolic pressure failed to show the expected drop in 6 of 20 normal subjects pointing up the difficulty of interpreting the "bedside Valsalva." As the Valsalva maneuver is prolonged to 25 seconds, the cardiac outputs of the men drift back toward normal to a greater extent than those of women. At the time of release women increased the blood flow by an average of 22% compared to the control, while men returned only to the resting control levels. (Authors' summary, modified) (19 references)

233
Bouhuys, A.
PULMONARY NITROGEN CLEARANCE IN RELATION TO AGE IN HEALTHY MALES. —— Jour. Applied Physiol., 18 (2): 297-300. March 1963.

Lung volumes and nitrogen clearance during oxygen breathing were recorded in 80 healthy males, 24-65 years of age. Lung volume changes with age were similar to those found in other studies. Uneven distribution of inspired gas in the lungs as estimated from N_2 clearance data showed relatively small changes with age, and the range of variability of these data was larger among the older subjects. The results suggest that impaired intrapulmonary gas distribution in older subjects is not a physiological consequence of aging, but may rather be related to long-term effects of inhaled noxious agents such as tobacco smoke. (Author's abstract)

234
Breslav, I. S.
[GAS PREFERENCE OF WHITE MICE EXPOSED TO OXYGEN AND CARBON DIOXIDE GRADIENTS] Gazovyi preferendum belykh myshei v usloviiakh gradienta kisloroda i uglekislogo gaza.—Doklady Akademii nauk SSSR (Moskva), 150 (5): 1168-1170. 1963. In Russian.

Mice were allowed a preferential selection of gas mixtures in a specially designed apparatus. When exposed to an atmosphere with an oxygen gradient from 21 to 9%, mice did not display any distinct preferences; however, their sensitivity was elevated when the nitrogen-oxygen atmosphere contained 3% CO_2. A hyperoxic atmosphere with an oxygen content of 60 to 90% produced a negative reaction as evidenced by a number of escapes into appropriate chambers. A CO_2 gradient of 0 to 6% in a normal atmosphere caused mice to select CO_2-free chambers in two thirds of the cases.

235
Campbell, E. J. M.,
E. D. Bennett, and D. Rubenstein
THE ABILITY TO DISTINGUISH BETWEEN ADDED ELASTIC AND RESISTIVE LOADS TO BREATHING. —Clinical Science (London), 24 (2): 201-207. April 1963.

A normal man, breathing through a circuit of low resistance, was made to inspire at intervals either from empty oil drums (elastic loads) or through narrow tubes (resistive loads). Three loads of each type were used: 3.5, 9.0 and 14.5 cm. water/liter elastic; 1.2, 3.8 and 7.0 cm. water/liter/second resistive. After each load was presented the subject was required to indicate whether it was elastic or resistive. The subject identified the type of load with significant accuracy when presented with the two higher loads of each type. The lowest resistive load was not detected at all on nearly half the presentations but was never called elastic. The lowest resistive load was always detected but was incorrectly called resistive almost as often as it was correctly called. At all levels there was a bias in favor of calling loads resistive, implying that information about flow was more acute than information about volume. The relation of sensory mechanisms in these findings are discussed. (Authors' summary, modified)

236
Chiang, S. T.
SIMPLE NEW DEVICE FOR DETECTION OF UNEVEN PULMONARY VENTILATION AFTER A SINGLE BREATH OF OXYGEN. — Jour. Lab. and Clinical Med., 61 (2): 346-351. Feb. 1963.

A method for detecting uneven pulmonary ventilation of inspired gas which is based on the single-breath technique is described. This method offers the advantages of the simplicity and economy of equipment which can be constructed in any pulmonary function laboratory. In addition, the easy manipulation of the instruments and the limited participation on the part of the subjects make the test more convenient. Values for normal subjects and patients with respiratory diseases are presented. (Author's summary, modified)

237
Colard, M.,
J. P. Mallie, J. Duvernoy, and P. Bouverot
[STUDY OF THE OXYGEN AND CARBON DIOXIDE STIMULUS OF VENTILATION IN THE RABBIT]. Étude des stimulus O_2 et CO_2 de la ventilation chez le lapin.—Annales scientifiques de l'Université de Besançon (Besançon), sér. 2 (Médecine), 1962 (6): 85-90. 1962. In French.

In the normal anesthetized rabbit the induction of abrupt, transitory, and moderate hypercapnia and hyperoxia produced an early ventilatory response (hyperventilation). In the animal deprived of arterial chemoreceptors, this rapid ventilatory response was suppressed. From these facts it was concluded that there exists a chemoreflex mechanism of action for the oxygen and carbon dioxide stimulus of ventilation.

238
Craig, A. B.,
L. S. Halstead, G. H. Schmidt, and B. R. Schnier
INFLUENCES OF EXERCISE AND O_2 ON BREATH HOLDING. — Jour. Applied Physiol., 17 (2): 225-227. March 1962.

The arterial carbon dioxide tension at the breaking point was found to be higher during exercise than during rest in four subjects. The breaking-point curve during exercise was elevated over the entire range of various oxygen concentrations studied, indicating that whatever the changes produced they are related to the contribution of carbon dioxide to the urge to breathe and are independent of oxygen. At least part of the elevated arterial carbon dioxide tension may be accounted for by an overshoot of arterial carbon dioxide tension related to the rate of rise of carbon dioxide tension. This was shown by increasing the rate of accumulation of carbon dioxide by inhaling different oxygen-carbon dioxide gas mixtures to simulate the increased carbon dioxide production during exercise. However, certain calculations indicate that this is not the only difference between voluntary apnea during exercise as compared with that during rest. (Authors' abstract)

239
Craig, A. B.
CARDIOVASCULAR RESPONSES TO BREATHHOLDING IN AIR AND DURING DIVING IN MAN [Abstract]. — Physiologist, 5 (3): 122. Aug. 1962.

In breath-holding after maximal inspiration, the increased intrathoracic pressure is the relaxation pressure at this lung volume, and is transmitted directly to the carotid sinus causing a reflex slowing of the heart. The hypothesis of the present investigation is that after this initial response the heart rate is dependent upon the venous return, which determines the amount of blood available to the heart to pump and to create the pressure which the carotid sinus senses. If the subject is lying supine in air and maintains full inspiration with the glottis open, there is little change in heart rate during the apnea. If, instead, the subject exerts various positive intrathoracic pressures during standard breath-holds, the degree of tachycardia is directly proportional to the pressure. When the subject is tilted to the feet-down position after maximal inspiration and closure of the glottis, there is a tachycardia. This is contrasted to the bradycardia which results if the subject is tilted head-down after the beginning of the breath-hold. In the level position the slight tachycardia can be changed to a bradycardia by passively raising the extremities halfway during the breath-hold. These and other experiments in water are presented to emphasize the role of the venous return. (From the author's abstract)

240
Craig, A. B.,
and S. A. Babcock
ALVEOLAR CO_2 DURING BREATH HOLDING AND EXERCISE. —— Jour. Applied Physiol., 17 (6): 874-876. Nov. 1962.

When 12 healthy adult male subjects held their breath after breathing 100% oxygen, the partial pressure of carbon dioxide in the alveoli at the breaking point was higher when they exercised than when they were at rest. Attention was not a factor, and passive exercise did not produce a result different from rest. By repeated breath-holding experiments at different work loads it was possible to demonstrate a systematic error due to the sampling site, the alveolar air. When this error was examined quantitatively, it was found that there is probably no difference in the carbon dioxide tension at some critical sensing site at the breaking point under the different conditions of voluntary apnea. Our results imply that exercise may not change the sensitivity to carbon dioxide, or at least the sensitivity is not decreased. (Authors' abstract)

241
Cox, J. R.,
G. A. B. Davies-Jones, P. J. Leonard, and
B. Singer
THE EFFECT OF POSITIVE PRESSURE RESPIRATION ON URINARY ALDOSTERONE EXCRETION.— Clinical Science (London), 24 (1): 1-5. Feb. 1963.

In normal trained subjects continuous positive-pressure respiration for one-half hour resulted in a significant increase in aldosterone excretion and a significant decrease in the urinary sodium:potassium ratio. No accompanying significant increase in urinary 17-hydroxycorticosteroids was found. (Authors' abstract, modified)

242
Daly, W. J.,
and S. Bondurant
DIRECT MEASUREMENT OF RESPIRATORY PLEURAL PRESSURE CHANGES IN NORMAL MAN.—Jour. Applied Physiol., 18 (3): 513-518. May 1963.

Using a specially designed needle system, pressures were recorded directly from the pleural space in seated normal men. Respiratory pressure changes (ΔP) measured simultaneously from different pleural sites and the esophagus were not the same but became so after a large pneumothorax was produced. In the absence of pneumothorax, ΔP was less in the upper than in the lower chest. This may be an expression of a gradient either of distribution of ventilation or of elastic forces opposing expansion of the lung. In three of four subjects, end expiratory pressure was more positive in the low chest than in the high chest. Acute central vascular engorgement (pressure suit inflation) caused similar changes in esophageal and intrapleural ΔP. These observations confirm the previously observed decrease in lung compliance during acute central vascular engorgement and provide evidence of local differences in respiratory pleural pressure changes in man. (From the authors' abstract)

243
Daly, W. J.,
D. Cline, and S. Bondurant
EFFECTS OF BREATHING OXYGEN ON ATRIOVENTRICULAR CONDUCTION.—American Heart Jour., 66 (3): 321-324. Sept. 1963.

Electrocardiographic recordings from 11 normal subjects breathing 100% oxygen from a high-flow, low-resistance mask system for 10 minutes showed small but statistically significant decreases in heart rate. Mean heart rate decreased from 72 ± 8 to 66 ± 8 ($p = 0.001$). The P-R interval was not affected.

244
Davison, R. A.
VENTILATION OF THE NORMAL AND BLOCKED MIDDLE EAR: A REVIEW OF MECHANISMS.— School of Aerospace Medicine. Aerospace Medical Division, Brooks Air Force Base, Tex. Aeromedical Review no. 7-62, Nov. 1962. 17 p.

The advantages and disadvantages of the Valsalva maneuver and the Frenzel maneuver as mechanisms of ventilating the middle ear are reviewed. Other mechanisms (Toynbee maneuver, Politzerization, Eustachian tube catheterization) of eustachian tube inflation, with only minor importance for voluntary in-flight use, are also reviewed for completeness. Although the Valsalva maneuver serves adequately to ventilate the blocked ear in most cases, its predisposition to cause syncope and its relative inefficiency warrant re-evaluation of alternative methods. From pilot studies it appears that the Frenzel maneuver may be of use in the prevention of these maladies. It is hoped that future studies will be conducted to clarify the efficacy of the Frenzel maneuver. (28 references)

245
Defares, J. G.
A MODEL OF THE RESPIRATORY "CHEMOSTAT" WITH "ACCESSIBLE" PARAMETERS. —— Annals New York Acad. Sci., 96 (4): 956-961. March 2, 1962.

A review and criticisms are presented of previous models for carbon dioxide feed-back analysis. A new model is described for which all parameters can be measured experimentally. Ventilation is made a function of the arterial carbon dioxide pressure and the rate of change of pressure. A mathematical analysis is presented, and a diagram of the electrical equivalents is given.

246
Doležal, V.
THE EFFECT OF LONGLASTING OXYGEN INHALATION UPON RESPIRATORY PARAMETERS IN MAN. — Physiologia bohemoslovenica (Praha), 11 (2): 149-158. 1962. In English.

The effect of long-lasting oxygen inhalation (average concentration, 95%) upon the respiratory system was studied in 12 healthy human subjects in a decompression chamber. The average exposure time to the oxygen atmosphere was 74 hours, with a minimum of 42 hrs. and a maximum of 110 hrs. The first subjective difficulties appeared after 8-14 hrs., manifested by retrosternal pains during inspiration, irritating cough, and later by dyspnea. In the course of the experiment nausea, loss of gustatory sensations, and vomiting appeared. Most subjects reported anesthesia of finger tips and toes. These symptoms disappeared 14-21 days after termination of oxygen inhalation. During the experiment, the average loss of body weight was 1.4%. The minute respiratory volume was increased by 39%. This hyperventilation was accompanied by a decrease of pCO_2 and an increase of pH in the arterial blood. The vital capacity of the lungs diminished by 17.2%. The O_2 tension in arterial blood increased in the course of the O_2 inhalation and reached 100% after 14 hrs. It is postulated that the hyperventilation during O_2 breathing represents a protective mechanism which maintains vasoconstriction in the cerebral circulation, via hypocapnia, and thus protects brain cells from high pO_2. (Authors' summary, modified)

247
Doležal, V.,
F. Vorel, and J. Anděl
EFFECT OF PROLONGED OXYGEN INHALATION AT NORMAL BAROMETRIC PRESSURE ON CARBOHYDRATE METABOLISM IN RATS. — Physiologia bohemoslovenica (Praha), 11 (3): 236-242. 1962. In English.

Carbohydrate metabolism in an oxygen atmosphere at normal barometric pressure was studied in a group of 40 rats. It was found that prolonged inhalation of oxygen significantly influenced the blood glucose, pyruvic acid, and lactic acid levels. The brain lactic acid did not alter significantly until hypoxia developed in the experimental animals; this steadily progressed as a result of injury to the lungs by the oxygen and reduction of the contact area of the lungs for saturation of the arterial blood. The hypothesis is formulated that during the first phase of exposure to oxygen, carbohydrate metabolism is influenced by the raised oxygen tension in the tissues, while in the second phase it is influenced by hypoxia. During the first phase the blood glucose, lactic acid, and pyruvic acid levels fall, while as hypoxia develops they gradually rise. With the development of anoxia metabolism has broken down and the brain lactic acid level rises. (Authors' summary)

248
Doležal, V.
SOME HUMORAL CHANGES IN MAN PRODUCED BY CONTINUOUS OXYGEN INHALATION AT NORMAL BAROMETRIC PRESSURE. — Rivista di medicina aeronautica e spaziale (Roma), 25 (2): 219-233. April-June 1962. In English.

Twelve normal males breathed oxygen (96%) in a closed and ventilated chamber for 42-110 hours (average, 74 hours). Severe pulmonary lesions, and some neurological manifestations, were observed in all subjects. No bronchopneumonia was diagnosed except in one case where pleural exudate was found. A significant decrease was determined in serum albumin and a significant increase in $alpha_2$- and gamma globulins. No changes were seen in whole-blood proteins or in serum minerals except in the potassium/calcium ratio. Glucose, lactic acid and pyruvic acid in arterial blood, and oxygen consumption showed no significant variations. (34 references)

249
DuBois, A. B.
OXYGEN TOXICITY. — Anesthesiology, 23 (4): 473-477. July-Aug. 1962.

The administration of high oxygen concentration using an airtight system results in the rapid absorption of gases from closed spaces in the body. Atelectasis, accompanied by engorgement of the lungs and by right to left shunting of blood, may ensue. There is some suppression of the respiratory impulses arising from the carotid body, and hence a decreased ventilatory stimulus. This may result in an increase in arterial carbon dioxide tension if the ventilatory response to carbon dioxide is not adequate. These effects are counteracted by assisted ventilation. In normal man, there is a decrease in cardiac output when breathing oxygen, but this is abolished by atropine. When administered over a period of days, oxygen may produce chemical effects in the alveolar cells resulting in a picture of pulmonary edema, atelectasis, pneumonia, and alveolo-capillary block. At 3 atmospheres, pure oxygen brings on convulsions owing to the chemical action of oxygen on the brain cells. The chemical effects probably are due to inhibition of cellular metabolic processes by oxidation of certain enzymes, and the presence of ionizing radiation accentuates these effects. (From the author's summary) (22 references)

250
Duvoisin, R. C.
CONVULSIVE SYNCOPE INDUCED BY THE WEBER MANEUVER. — Arch. Neurol., 7 (3): 219-226. Sept. 1962.

Responses to the Weber or Valsalva maneuver (straining against a closed glottis as long as possible) were observed in 200 males of military age and monitored with simultaneous electroencephalographic and electrocardiographic recordings. Sixty-one succumbed in syncopal episodes which were accompanied by a progressive slowing of the EEG culminating in extreme cases in electrical silence. Convulsive phenomena supervened on 54 occasions.

These were distinctive in character and possessed features which render it difficult to view them merely as epileptic seizures triggered by anoxia. The convulsive movements and the EEG patterns resembled those described for convulsive syncope secondary to a reflex cardiac asystole, and to phenomena observed in men subjected to acute hypoxia in a low-pressure chamber. (Author's summary, modified)

251
Eggers, G. W. N.,
H. W. Paley, J. J. Leonard, and J. V. Warren
HEMODYNAMIC RESPONSES TO OXYGEN BREATHING IN MAN. —— Jour. Applied Physiol., 17 (1): 75-79. Jan. 1962.

Hemodynamic responses to breathing 100% oxygen for an average of 30 minutes were studied in eight healthy male volunteers. Cardiac output and related determinations were performed with central injections of a radioactive indicator. Slight but statistically significant decreases in cardiac index and heart rate were observed during oxygen breathing. There was no change in the central blood volume, but a masked increase in pulmonary blood volume may have occurred. Statistically significant increases in peripheral vascular resistance, mean arterial pressure, and both systolic and diastolic arterial pressures occurred during oxygen breathing and persisted at least 40 minutes after oxygen was discontinued. (From the authors' abstract)

252
Ellis, J. P.,
and J. G. Wells
THE DETECTION OF IN-FLIGHT HYPERVENTILATION BY BLOOD AND URINE ANALYSES.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Project no. 7758, Task no. 59591). Technical Documentary Report no. 62-117, Nov. 1962. iii+6 p.

An alternate method for the detection of in-flight hyperventilation in pilots was investigated. The method is based on the measurement of several acid-base related components in blood and urine, and is more convenient and practical than the previously described method based on the measurement of alveolar carbon dioxide tension in end-expired air samples collected during flight. The data indicated that when a relatively small degree of hyperventilation is experienced by pilots, as indicated by the in-flight alveolar carbon dioxide tension, the corresponding small change in blood and urine components is insignificant. When the in-flight alveolar carbon dioxide tension indicates a greater degree of hyperventilation, however, blood and urinary variables are significantly changed. It is concluded that the method can detect hyperventilation at a level of concern. (Authors' abstract)

253
Farhi, L. E.,
T. Homma, D. Berger, and D. Busby
TISSUE N_2 WASHOUT IN THE WHOLE ANIMAL AND IN INDIVIDUAL ORGANS [Abstract]. —— Physiologist, 5 (3): 138. Aug. 1962.

Analysis of mixed venous blood following nitrogen washout from the lungs shows that in the anesthetized dog 80 to 90% of the total nitrogen is stored in a "slow" compartment perfused by 10 to 15% of the cardiac output and having a time constant of 150 to 250 minutes. Most of the remaining nitrogen (7-15% of total) is in areas receiving 20 to 30% of the total blood flow, the time constant being 10 to 15 minutes. Thus more than 50% of the cardiac output perfuses areas in which less than 5% of the total nitrogen is stored. The washout curve of individual organs is obtained by sampling venous blood returning from organs or regions and allows one to determine the elements that contribute to each of the compartments. It is also possible to calculate blood flow to an organ by measuring the time constant of the nitrogen washout curve. (Authors' abstract)

254
Farhi, L. E.,
A. W. T. Edwards, and T. Homma
DETERMINATION OF DISSOLVED N_2 IN BLOOD BY GAS CHROMATOGRAPHY AND (a-A)N_2 DIFFERENCE. —— Jour. Applied Physiol., 18 (1): 97-106. Jan. 1963.

By combining vacuum extraction in a Van Slyke chamber and separation of the extracted gases in a gas chromatograph, it is possible to determine nitrogen content of 1.5 ml. of blood or other biological fluids in less than 10 minutes. The 95% confidence limits are 0.44% on either side of the mean of the triplicate analysis–or 2.4 mm. nitrogen tension (P_{N_2}) in arterial blood when breathing room air. Application of the method to the problem of arterial-alveolar nitrogen difference yielded the following data: (1) nitrogen solubility in whole blood at 37.3° C. varied from 0.0125 to 0.0129; (2) nitrogen solubility in urine is inversely related to urine specific gravity; (3) changes in arterial nitrogen content were reflected in arm superficial venous blood and urine nitrogen only after a considerable period of time, indicating that either of these will give an excellent indication of the mean P_{N_2} over a period of time; (4) there is no systematic difference between venous blood and urine P_{N_2}; and (5) the (a-A)N_2 difference in nine normal subjects varied from 3.7 to 13.1 mm. Hg. (Authors' abstract)

255
Fisher, V. J.,
and L. C. Christianson
CEREBROSPINAL FLUID ACID-BASE BALANCE DURING A CHANGING VENTILATORY STATE IN MAN.—Jour. Applied Physiol. 18 (4): 712-716. July 1963.

Comparison of the rate and magnitude of changes in pH, carbon dioxide tension, and bicarbonate concentration in arterial blood, cisternal spinal fluid, and lumbar spinal fluid was made in man during hyperventilation and recovery. Carbon dioxide tension changes in cisternal fluid were rapid and significant, although less in magnitude than those in arterial blood, whereas changes in lumbar fluid CO_2 tension were minimal and slow, lagging behind cisternal changes by 10-20 minutes. The different rates of change following altered ventilation explained some of the reported reversals of the normal lumbar spinal fluid to arterial blood CO_2 tension gradients. It also suggests that the choroid plexus is one site of removal of CO_2 from spinal fluid. (Authors' abstract)

256
García Ramos, J.
THE FACTORS WHICH DETERMINE THE LUNG'S DISTENSIBILITY.—Acta physiologica latino americana (Buenos Aires), 12 (2): 129-138. 1962. In English.

Distensibility of the lung was studied in rabbits, guinea pigs, cats, and dogs under the following conditions: lung inflation, vagal stimulation, occlusion of a pulmonary artery, hypoxia, and hemorrhage. The results indicate that the lung's distensibility depends on the amount of extravascular fluid. This amount varies under normal conditions and is influenced by mechanical factors and nervous mechanisms and appears to be primarily controlled by enzyme systems sensitive to oxygen tension changes. With reference to the effects of hypoxia, two factors can be invoked: vasodilatation and increase in capillary permeability. It is also possible that nervous mechanisms intervene.

257
Gerschman, R.,
A. E. Argüelles, and D. I. Ibeas
EFFECTS OF HIGH OXYGEN TENSIONS ON MAMMALIAN GONADS [Abstract].—International Congress of Physiological Sciences, 22 (Leiden, 1962), Proceedings, vol. 2, no. 357. Amsterdam [1962?].

Young and adult mice and hamsters were exposed to a partial oxygen pressure of 0.7 atmosphere. Depending on the length of exposure (a few days to a few weeks), there were either no evident changes or severe changes in the seminiferous elements. Changes were seen in the intertubular spaces and in the germinal epithelium. In the former a variable degree of serous edema was found, while the Leydig cells appeared normal; in the latter there was an arrest of spermatogenesis. (Authors' abstract, modified)

258
Gleason, T. L.
and R. H. Edwards
CHIMPANZEE PHYSIOLOGICAL TOLERANCE TO BREATHING 100% OXYGEN AT 15 PSI.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6892, Task no. 689202). Technical Documentary Report no. ARL-TDR-63-14, May 1963. vii+138 p.

In a counterbalanced experiment four restrained, immature chimpanzees were subjected to a 100% oxygen environment at 14.7 psia for over 15 hours. During this period they were isolated in a chamber and performed various psychomotor tasks. These same animals served as subjects for the same period of time in a 20% oxygen environment. Relative humidity was maintained at 45-55%; temperature was maintained at 79-81°F.; environmental CO_2 was lower than 3.8 mm. Hg. Heart rate, respiratory rate, and skin and rectal temperatures were monitored during the experiments. Clinical examinations, hematological and serum biochemical determinations, and urinalyses were performed before and following each test. The only significant findings were a relative bradycardia and tachypnea in the hyperoxygenated environment. (Authors' abstract) (25 references)

259
Griffo, Z. J.,
and A. Roos
EFFECT OF O_2 BREATHING ON PULMONARY COMPLIANCE. — Jour. Applied Physiol., 17 (2): 233-238. March 1962.

The effect of oxygen breathing on pulmonary compliance was studied in paralyzed, artificially ventilated dogs and in two normal humans. In the dogs and the human subjects the course of compliance during oxygen breathing for periods of 1 1/2 to 2 hours following hyperinflation was compared with that during air breathing. In dogs compliance after apnea on oxygen (following hyperinflation) for 1/2 to 7 minutes was compared with that after apnea on air. Intrapulmonary pressure during apnea was atmospheric. In the human subjects the course of compliance was followed during air breathing for 50-70 minutes, preceded by hyperinflation and immediately followed by oxygen breathing for 80-100 minutes. In none of these sets of studies did oxygen breathing affect the course or magnitude of pulmonary compliance. It is concluded that breathing pure oxygen at atmospheric pressure for several hours does not enhance the development of pulmonary atelectasis in normal subjects. (Authors' abstract)

260
Hall, K. D.,
and F. H. Reeser
SERUM POTASSIUM LEVELS IN HYPERVENTILATED DOGS. — Proc. Soc. Exper. Biol. and Med., 111 (2): 251-252. Nov. 1962.

Anesthetized dogs which were passively hyperventilated with a sinusoidal pump (intermittent positive pressure) for 6 hours developed severe respiratory alkalosis. Serum potassium concentration increased slightly in the first four minutes, then decreased markedly during the next two hours. For at least 20 minutes after cessation of hyperventilation the potassium level did not begin to increase, even though the arterial carbon dioxide tension increased. (Authors' summary, modified)

261
Hamer, N. A. J.
VARIATIONS IN THE COMPONENTS OF THE DIFFUSING CAPACITY AS THE LUNG EXPANDS.—Clinical Science (London), 24 (2): 275-285. April 1963.

Components of the diffusing capacity were estimated at different lung volumes in seven normal subjects by measuring the diffusing capacity by the breath-holding method at two different oxygen tensions. The membrane component of the diffusing capacity (D_M) increased approximately in proportion to lung volume from a half to total lung capacity. This change was consistent with expansion of the alveoli and stretching of their walls or with recruitment of alveoli as the lung was inflated. There was no evidence of folding of the alveolar walls at smaller lung volumes over the range studied. Pulmonary capillary blood volume (V_c) decreased as the lung expanded from a half to three-quarters of lung capacity, and counteracted the increase in the membrane component so that there was little change in the total diffusing capacity. At larger lung volumes the changes in V_c were variable, it seemed likely that there was a tendency for V_C to increase as lung volume rose as a result of the effects of forceful inspiration and breath-holding. (Author's summary, modified) (32 references)

262
Harden, K. A.,
R. G. Bartlett, H. Barnes, L. Reid, A. Barthakur, and W. P. Waters
OXYGEN COST OF BREATHING. I. — Amer. Rev. Respir. Diseases, 85 (3): 387-391. March 1962.

The results of 58 determinations of the oxygen cost of breathing in 33 normal subjects during hyperventilation have been presented. The absolute results and the increments with different levels of ventilation were reasonably comparable to the reported results with more sophisticated techniques. A mean value of 2.55 milliliters per liter of ventilation with a range of 0.7 to 4.0 included the majority of subjects studied. Among 12 subjects who had multiple determinations, the majority reproduced their original values within 0.5 milliliters. (Authors' summary)

263
Hart, M. C.,
M. M. Orzalesi, and C. D. Cook
RELATION BETWEEN ANATOMIC RESPIRATORY DEAD SPACE AND BODY SIZE AND LUNG VOLUME. — Jour. Applied Physiol., 18 (3): 519-522. May 1963.

The respiratory anatomic dead space was measured by the single-breath nitrogen washout method of Fowler in 73 normal subjects ranging from 4 to 42 years of age. The volume of the anatomic dead space correlated closely with height, but also with body weight, surface area, and functional residual capacity. When compared on the basis of any of these parameters there was no significant difference between the anatomic dead space values for males and females. Comparisons with available data for newborn infants suggest that the value of the anatomic dead space has a relatively constant relation to height from birth to adulthood. (From the authors' abstract)

264
Hornbein, T. F.,
and A. Roos
EFFECT OF MILD HYPOXIA ON VENTILATION DURING EXERCISE. — Jour. Applied Physiol., 17 (2): 239-242. March 1962.

Hypoxia of mild degree (arterial oxygen tension above 60 mm. Hg) produces little or no ventilatory response in resting man during the steady state. To evaluate the possibility that the effectiveness of a hypoxic chemoreceptor drive might be enhanced by exercise, the ventilatory response to mild hypoxia was measured in two human subjects during rest and exercise. Though no significant increase in ventilation occurred at rest above an arterial oxygen tension of 60 mm. Hg, a decrease in arterial oxygen tension from 100 to 94 mm. Hg produced a statistically significant increase in steady-state ventilation during moderate exercise. In addition, temporary block of the sympathetic innervation to the carotid and aortic bodies in one subject resulted in a diminution of work hyperpnea. This suggests that increased sympathetic tone during exercise, by reducing blood flow through the chemoreceptors, might result in increased neural discharge and hence increased ventilation even though arterial oxygen tension is the same as at rest. Thus, activity of the chemoreceptors as modified by sympathetic control of their blood supply may be an important determinant of the ventilatory response to exercise. Since work hyperpnea is enhanced by even mild hypoxia, this ventilatory response may be sufficient to initiate respiratory acclimatization to altitudes so low that resting ventilation on acute exposure is unaffected. (Authors' abstract)

265
Houdas, Y.,
and R. Falet
[ON WATER ELIMINATION BY THE RESPIRATORY TRACT] Sur les éliminations d'eau par les voies respiratoires.—Revue de médecine aéronautique (Paris), 2 (8): 409-410. Aug.-Sept. 1963. In French.

Water lost by six adults through respiration at 15° C. and 760 mm. Hg was measured three to five times for each. The total water lost in expiration was weighed and calculated in mg. of water per g. of dry air. It was determined that if the expired air was saturated, its temperature ranged between 30 and 35° C., but if the temperature of the expired air was close to 37° C., the air was unsaturated.

266
Hyatt, R. E.,
and R. E. Wilcox
THE PRESSURE-FLOW RELATIONSHIPS OF THE INTRATHORACIC AIRWAY IN MAN. — Jour. Clinical Investigation, 42 (1): 29-39. Jan. 1963.

The gas-velocity profile in the trachea was evaluated in five conscious subjects by simultaneous direct measurement of lateral and impact tracheal pressures. The profile was found to be nearly blunt during both inspiration and expiration for flows ranging from 0.5 to 4.5 liters per second. Isovolume pressure-flow curves of the lower airway (alveolus to trachea) were obtained. From a knowledge of the tracheal velocity profile it was possible to separate the lower airway pressure drop into two components, one related to the frictional losses in the gas and one to the convective acceleration of the gas (Bernoulli effect). Failure to consider the pressure drop due to convective acceleration leads to an overestimation of expiratory frictional resistance and underestimation of inspiratory frictional resistance. (From the authors' summary)

267
Jacquemin, C.,
P. Varène, and J. Colin
[VALUE OF ANALOGOUS METHODS IN RESPIRATORY PHYSIOLOGY APPLIED TO AERONAUTICS] Intérêt des méthodes analogiques en physiologie respiratoire appliquée en aéronautique. — Revue de médecine aéronautique (Paris), 1 (4): 69-74. July-Aug. 1962. In French.

Analogous calculations made by unitary and frequential analysis are applied to respiratory physiology, especially to the mechanics of ventilation. The principal elements considered are compliance (static and dynamic), dynamic resistance (function of debit), and impedance (function of inertia). These calculations may be applied to aviation in dealing with positive and negative pressure respiration, applied research on respiratory equipment and biology, emergency conditions, and respiration during astronautical accelerations and vibrations.

268
Jacquemin, C.,
P. Varène, and P. Richard
[VENTILATION BEHAVIOR IN MAN'S RESPIRATION IN HYPERPRESSURE] Le comportement ventilatoire de l'homme respirant en surpression.—Revue de médecine aéronautique (Paris), 2 (8): 444-446. Aug.-Sept. 1963. In French.

Against the classic theory of teaching pilot candidates to expire actively under hyperpressure, the authors suggest that the candidates be taught to accept the passive distention due to pressure rather than to fight it since inspiration remains active and only the functional residual capacity of the lungs is increased. It appears unnecessary to employ the abdominal muscles which are not used in ordinary respiration. The theoretical interpretations of the diagrams of pressure and volume also need revision.

269
Johnson, L. F., 1963
and J. Mead
VOLUME-PRESSURE RELATIONSHIPS DURING PRESSURE BREATHING AND VOLUNTARY RELAXATION. —Jour. Applied Physiol., 18 (3): 505-508. May 1963.

Lung volumes during pressure breathing (PB) were measured in six subjects by two methods: (1) The subject was seated completely enclosed in a body plethysmograph breathing room air through a tube; pressures were applied to this tube and volume changes were recorded from the plethysmograph. (2) The subject was seated enclosed in a body box except for his head which protruded through a respirator collar; pressures were applied around the body and lung volume changes were recorded from a bag-box system. In addition, relaxation pressure (RP) measurements were obtained. Volume-pressure relationships by PB 1 closely approximated those by RP, whereas PB 2 tended to yield smaller volume changes for a given pressure than the other methods. The extrathoracic airways are subjected to the applied pressure in PB 1 and RP, but not in PB 2. The different results may relate to this difference. (Authors' abstract)

270
Kaufman, W. C.
VENTILATORY RESPONSES TO PRESSURE BREATHING.—Revue de médecine aéronautique (Paris), 1 (2): 162-164. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (1): 19-20. Jan. 1963.

In six subjects during positive-pressure breathing both respiratory rate and tidal volume increased. Minute volume increased 100%, alveolar ventilation 105%. Alveolar carbon dioxide pressure decreased 25% to 25 mm. Hg. Elimination of carbon dioxide increased 47%, and 800 cc. of carbon dioxide above the control value were eliminated during a five-minute period. During negative-pressure breathing, hyperventilation was less severe and elimination of carbon dioxide increased only 16%, alveolar carbon dioxide decreasing to 31 mm. Hg. Although no subject experienced ill effects from hypocapnia, alveolar carbon dioxide reached a critical level. Two explanations for hyperventilation are postulated. Normal respiratory control mechanisms may be modified (1) by emotional responses of untrained subjects to unusual respiratory requirements, or (2) through afferent nervous activity elicited by stimulation of pulmonary stretch receptors. It is possible that additional carbon dioxide elimination is the product of greatly increased metabolic work. Training may prevent hyperventilation during positive pressure breathing and eliminate a potential source of difficulty for aircrew members. At this time the underlying mechanisms remain unknown.

271
Kocherga, D. A.
[ON THE TONIC FUNCTION OF THE RESPIRATORY MUSCLES] O tonicheskoi funktsii dykhatel'nykh myshts.—Doklady Akademii nauk SSSR (Moskva), 151 (2): 468-470. 1963. In Russian.

Electromyograms of external and internal intercostal muscles, diaphragm, and obliquus externus abdominis were obtained from three dogs at complete rest, and electromyograms of the m. extensor carpi radialis, m. brachioradialis, and m. ext. carpi ulnaris from controls. The bioelectrical activity of the respiratory musculature was of two types: the phasic type correlated with the respiratory cycle, and the tonic type which was constant during the cycle. The tonic activity was present in all respiratory muscles; however, in the intercostals and the externus abdominis it was more pronounced than in the diaphragm. During head turns the tonic changes of the respiratory muscles were of the type previously described in the extensors of anterior extremities. It is concluded that the respiratory muscles are regulated not only through the respiratory center in the medulla oblongata but are also subject to mediation of the central nervous system.

272
Kubicek, W.,
E. Kinnen, and A. Edin
THORACIC CAGE IMPEDANCE MEASUREMENTS: CALIBRATION OF AN IMPEDANCE PNEUMOGRAPH.—Univ. of Minnesota. Depts. of Physical Medicine and Electrical Engineering, Minneapolis (Contract AF 41(657)-403); issued by School of Aerospace Medicine. Aerospace Medical Division, Brooks Air Force Base, Tex. (Task no. 775801). Technical Documentary Report no. SAM-TDR-63-41, July 1963. iii+7 p.

An experimental calibration of an electrical impedance pneumograph is presented over a range of tidal volumes from 250 to 4,000 cc. Transthoracic impedance measurements were made on four subjects, by use of 1-inch cup electrodes and at a frequency of 100 kc. A 1-ohm change of impedance magnitude corresponding to an average tidal volume of 830 cc. was observed on the basis of 1,063 measurements. The standard deviation of these data was approximately 50% for low tidal volumes and 30% for the larger tidal volumes. Data from individual subject trials indicated significant variations in the calibration constants and regions of apparent linearity, both between subjects and between trials on each subject. (Authors' abstract)

273
Kylstra, J. A.,
M. O. Tissing, and A. van der Maën
OF MICE AS FISH. —— Trans. Amer. Soc. for Artificial Internal Organs, 8: 378-383. 1962.

A method is described by which it is possible to maintain adult white mice alive for up to 18 hr. while breathing a balanced and buffered salt solution at 20° C. and in equilibrium with oxygen at a tension of 8 atmospheres absolute. Such mice with fluid filled airspaces have been observed making spontaneous and rhythmic respiratory movements while being subjected to uniform compression of up to 160 atmospheres, i.e., a pressure existing in the oceans at a depth of approximately one mile. (Authors' summary)

274
Lanphier, E. H.,
and H. Rahn
ALVEOLAR GAS EXCHANGE DURING BREATH HOLDING WITH AIR. —— Jour. Applied Physiol., 18 (3): 478-482. May 1963.

Four normal subjects used a partial rebreathing procedure to deliver frequent alveolar gas samples during breath-holding with air. In breath-holding during mild exertion, oxygen uptake declined steadily while carbon dioxide transfer dropped abruptly and later ceased entirely as alveolar carbon dioxide tension (P_{CO_2}) reached a virtual plateau. Arterial P_{CO_2} very early equaled mixed venous P_{CO_2} and then exceeded it increasingly. The plateau of alveolar P_{CO_2} was due in part to the fall in alveolar oxygen tension since decreasing oxygen uptake lessened the carbon dioxide-concentrating effect of lung-volume reduction while the P_{CO_2}-elevating effect of blood oxygenation was also diminishing. However, an important slowing of the rise in mixed venous carbon dioxide content and P_{CO_2} was also noted and remains unexplained. (From the authors' abstract)

275
Lichtneckert, S. J. A.,
and C. E. G. Lundgren
AN INDEX OF ALVEOLAR VENTILATION. —— Jour. Applied Physiol., 18 (3): 639-645. May 1963.

An alveolar ventilation index (IAV) is proposed which is calculated on the basis of nitrogen-elimination experiments of the multiple-breath type and which is independent of volume measurements. For its calculation the number of breaths and the sum of nitrogen percentages in end-tidal air are needed. The index figures are related to a standardized reference system which permits comparison of alveolar ventilation under different experimental conditions. The method is discussed with special reference to such problems as mean alveolar concentration, asynchronous emptying of unequally ventilated parts, and disturbance by tissue nitrogen. A limited number of experimental results is presented. The IAV was tried for reproducibility and susceptibility to various factors presumed to cause changes in alveolar ventilation. For comparison, part of the material was also analyzed with the lung clearance index. (Authors' conclusions)

276
Lloyd, T. C.,
and G. W. Wright
EVALUATION OF METHODS USED IN DETECTING CHANGES OF AIRWAY RESISTANCE IN MAN.— Amer. Rev. Respir. Diseases, 87 (4): 529-537. April 1963.

The following methods for detection of changes in airway resistance in man were examined: the body plethysmograph, Clements' rotary air-flow interrupter, the Wright peak flow meter, maximal breathing capacity, the expiratory flow-volume loop, and the forced expiratory vital capacity. The maximal midexpiratory flow rate and percentages of the vital capacity exhaled in one and in three seconds were calculated from the latter chart record. In a series with 10 normal subjects in whom bronchospasm and then relaxation were induced, corresponding changes in airway resistance as measured by the plethysmograph were found always to be present and to be of considerable magnitude. The maximal breathing capacity, maximal midexpiratory flow, and the flow at midvolume of a forced expiratory vital capacity displayed by the flow-volume loop showed significant changes in about 70% of those instances recognized by the plethysmograph. The peak flow and one-second per cent of vital capacity were minimally affected, while two essentially unchanged values represented the measurements made with the rotary interrupter and the three-second per cent of vital capacity. (Authors' summary, modified)

277
Loehning, R. W.,
H. Ueyama, and I. Ueda
BRAIN VOLUME STUDIES IN ANIMALS: EFFECTS OF HYPERCARBIA, HYPOXIA, AND INTRAVENOUS UREA. —— Anesthesia and Analgesia, Current Researches, 41 (5): 529-537. Sept.-Oct. 1962.

Brain enlargement resulted in craniotomized dogs breathing 10-15% carbon dioxide mixtures for periods up to 4 hours. Brain volume returned to control levels when the animals again breathed room air. Following a similar period of hypercarbia, and when dogs breathed room air, cerebrospinal fluid pressure fell to levels below those found initially. Craniotomized dogs breathing 6-10% oxygen mixtures showed an acute increase in brain volume which returned to control level shortly after the animals breathed room air. Over a period of the next three hours, brain size in 6 of the 7 animals progressively enlarged and was still increasing at termination of the experiments.

278
Marshall, R.
RELATIONSHIPS BETWEEN STIMULUS AND WORK OF BREATHING AT DIFFERENT LUNG VOLUMES. —— Jour. Applied Physiol., 17 (6): 917-921. Nov. 1962.

An electrophrenic stimulator has been used on anesthetized cats and dogs to investigate the intrathoracic pressure produced by a given stimulus at different lung volumes. With a stimulus of fixed strength the resulting intrathoracic pressure swing bears an inverse relationship to lung volume. The mechanical work done in response to a given stimulus is dependent on the viscoelastic properties of the lungs and chest wall. The muscular work resulting from a stimulus and the efficiency of the chest muscles are also dependent on the position of the diaphragm and possibly on the position of the remainder of the chest wall. (Author's abstract)

279
Mead, J.,
J. Milic-Emili, and J. M. Turner
FACTORS LIMITING DEPTH OF A MAXIMAL INSPIRATION IN HUMAN SUBJECTS. — Jour. Applied Physiol., 18 (2): 295-296. March 1963.

Simultaneous measurements of esophageal and gastric pressure during the performance of vital capacity maneuvers were made in trained and untrained normal adult subjects. The changes in transdiaphragmatic pressure from functional residual capacity to total lung capacity were found to result largely from changes in intraesophageal pressure, gastric pressure changing substantially in only two of the untrained subjects. In addition, six of the individuals were subjected to oscillating pressures during vital capacity maneuvers. Oscillatory flow at the mouth continued at maximum inspiratory levels in five of the subjects. It was concluded from these two sets of observations that antagonistic action of abdominal muscles and/or glottic closure does not limit lung expansion in most trained subjects; in these the limitations to further expansion appear to arise from the elastic recoil of the respiratory system and the diminishing effectiveness of the inspiratory muscles at high lung volumes. (Authors' abstract)

280
Mel'nikov, V. V.
THE ANALYSIS OF OXYHAEMOGRAMS RECORDED DURING BREATH-HOLDING.—Sechenov Physiol. Jour. USSR (Pergamon Press, New York), 47 (9): 1250-1257. Feb. 1962.

English translation of: K analizu oksigemogrammy pri zaderzhke dykhaniia.—Fiziologicheskii zhurnal SSSR (Moskva), 47 (9): 1142-1148. Sept. 1961. In Russian.

When the breath was held repeatedly in inspiration, involuntary restoration of respiration developed at a constant oxyhemoglobin level, the variations not exceeding 2% in 20 individuals and 4% in 40. Pneumograms revealed involuntary contractions of the respiratory muscles developing in almost all the subjects when the oxyhemoglobin had fallen by 1-4%, the individual levels being very constant. More than one-third of the subjects continued to hold their breath for a considerable time after the development of these contractions and when there was a considerable reduction of the oxyhemoglobin. The individual rate of fall was constant in repeated tests. The curve continued to fall after the resumption of respiration for a period equivalent to the time required for the blood to travel from the lungs to the ear. Restoration of the oxyhemogram proceeded steeply at first and then more slowly. The slowing in the rate of restoration which became clearly evident after 9-10 sec. from the commencement of the steep rise is explained by recirculation of the oxygen-enriched blood. (Author's summary)

281
Mostyn, E. M.,
S. Helle, J. B. L. Gee, L. G. Bentivoglio, and D. V. Bates
PULMONARY DIFFUSING CAPACITY OF ATHLETES.—Jour. Applied Physiol., 18 (4): 687-695. July 1963.

Nonactive and moderately active normal subjects, swimmers of average ability, long distance runners, and older ex-athletes were found to show no significant deviation from predicted values of carbon monoxide diffusing capacities (DL_{CO}), either in absolute terms or in relation to body surface area or lung midcapacity. The high DLCO in champion swimmers results from a larger than normal pulmonary capillary blood volume (V_c). It has been observed that normal subjects can increase the measured steady-state diffusing capacity (DL) during exercise by a "held inspiration" maneuver, but this increase is caused by an increased membrane diffusion component (D_m) per liter midcapacity and not by an increased V_c. Champion swimmers have a particular need of a high DL since they must be able to transfer large volumes of oxygen across the lung when the alveolar oxygen tension has fallen to low levels. (From the authors' abstract)

282
Muecher, H.,
and H. Heckhausen
INFLUENCE OF MENTAL ACTIVITY AND ACHIEVEMENT MOTIVATION ON SKELETAL MUSCLE TONUS. — Perceptual and Motor Skills, 14 (2): 217-218. April 1962.

Thirty-three students carried out tasks such as (1) unrestricted imagery in response to visual stimulation, (2) mental multiplication of digits under stress of excessive pacing, and (3) unrehearsed speech. Electromyographic recordings were taken in phase with mental activity and rest. Tonus levels were raised during activity above those found during rest. Recordings of subjects high in achievement motivation as indicated by the thematic apperception test were higher than those of students with low or medium achievement motivation.

283
Muneeruddin, M.
EXCESS OF OXYGEN.—Pakistan Med. Jour. (Karachi), 13 (11): 13-19; (12): 9-16. Nov. and Dec. 1962.

Excess inhalation of oxygen leads to many physiological body changes, namely in the tension of blood gases (oxygen, carbon dioxide, nitrogen), blood cells, cardiac output, and blood vessels. Breathing of 70-100% oxygen results in various clinical manifestations including substernal distress, decreased pulse rate, slight increases in diastolic pressure, respiratory changes, and pulmonary damage (atelectasis, edema, reduced vital capacity, apnea). Consideration is given to the use of oxygen in treating anaerobic infections, migraine, denitrogenation of the body before high altitude flying, carbon dioxide poisoning, and postoperative recovery. Also reviewed are the clinical manifestations of hyperoxygenation under high pressure.

284
Nissen-Meyer, S.
INTERRELATIONS BETWEEN VARIABLES IN PULMONARY GAS EXCHANGE. —— Acta physiologica scandinavica (Oslo), 54 (Supplementum 188). 47 p. 1962. In English.

Approximate analytical relations between moderate variations in the ventilation/blood flow ratio through the lungs, mean alveolo-capillary gas gradients, and rates of gas exchange which can be obtained under specified conditions, have been developed on a theoretical basis. The most important parameters which influence the above are the overall ventilation/blood flow ratio, venous gas concentrations, and composition of inspired air. Numerical results obtained when atmospheric air is inspired and values within normal ranges inserted for the various parameters, indicate that the oxygen gradients produced by a varying ventilation/blood flow ratio are roughly 10 times greater than the carbon dioxide gradients. The carbon dioxide gradient increases when there is a general hyperventilation of the lungs. The theoretical relations between arterio-alveolar carbon dioxide gradients and differences between physiological and anatomical dead space are discussed. These differences will have approximately the same order of magnitude as the mean alveolo-capillary oxygen gradient. The size of the physiological dead space appears to increase in relation to the oxygen gradient with increasing predominance of hyperventilation. (Author's summary, modified)

285
Perez-Cruet, J.
CONDITIONING OF EXTRASYSTOLES IN HUMANS WITH RESPIRATORY MANEUVERS AS UNCONDITIONAL STIMULUS.—Science, (Washington), 137 (3535): 1060-1061. Sept. 28, 1962.

Out of 152 subjects 13, when signaled with lights to hold their breath, induced one extrasystole in one out of 10 trials. Six subjects showing a percentage of trials with unconditional extrasystoles of 15-92% incidence were used for the conditioning experiments. Three of the subjects showed evidence of conditioning, and extinction of the conditioned extrasystoles was accomplished. The stimuli which signaled inspiration and expiration appeared to acquire the characteristics of the respiratory movements by inducing extrasystoles in the process of normal breathing. Various brain mechanisms involved in the induction of the conditioned response are cited.

286
Pierce, E. C.,
and L. D. Vandam
INTERMITTENT POSITIVE PRESSURE BREATHING. —— Anesthesiology, 23 (4): 478-492. July-Aug. 1962.

A review is presented of the literature dealing with intermittent positive pressure breathing, including a definition, and the history of its development. The physiological effects of intermittent positive pressure breathing on the circulation and respiration are noted. The mechanics of breathing and the physics of automatic ventilators are briefly discussed insofar as they relate to certain clinical situations. (69 references)

287
Pierce, E. C.,
C. J. Lambertsen, M. J. Strong, S. C. Alexander, and D. Steele
BLOOD Pco_2 AND BRAIN OXYGENATION AT REDUCED AMBIENT PRESSURE. —— Jour. Applied Physiol., 17 (6): 899-908. Nov. 1962.

Hyperventilation during breathing of 100% oxygen elevates the oxygen tension (Po_2) of alveolar gas by the same amount that it lowers its carbon dioxide tension (Pco_2). Since the development of arterial hypocapnia causes cerebral vasoconstriction, brain oxygenation is drastically decreased even while arterial oxygenation is improved by hyperventilation. Administration of 30% carbon dioxide with oxygen at an ambient pressure equivalent to that at 39,000 feet altitude prevented alkalemia and, in spite of hyperventilation, restored cerebral venous oxygenation to a level at least equivalent to that found when pure oxygen was breathed at rest at the same altitude. The respiratory minute volume during administration of carbon dioxide with oxygen was greater than when oxygen alone was breathed at reduced ambient pressure. Since neither arterial Po_2 nor cerebral venous Pco_2 values differed in these two experimental situations, the respiratory stimulation may represent the quantitative demonstration in man of a respiratory effect of carbon dioxide mediated by arterial chemoreceptor activation and unrelated to change in the level of central chemical stimulus. (Authors' abstract)

288
Piiper, J.
[THEORETICAL ANALYSIS OF THE ALVEOLAR-CAPILLARY O_2 DIFFUSION BASED ON DIFFERENT ASSUMPTIONS ABOUT THE SITE OF DIFFUSION RESISTANCE] Theoretische Untersuchung der alveolär-capillären O_2-Diffusion bei verschiedenen Annahmen über die Lage des Diffusionswiderstandes. —— Pflügers Archiv für die gesamte Physiologie (Berlin), 275 (2): 173-192. 1962. In German, with English summary (p. 191).

The significance of the locus of the resistance to the alveolar-capillary O_2 diffusion is examined theoretically. The process of O_2-tension equilibration is analyzed for two extreme model cases: (1) the total resistance to O_2 diffusion is located in the "alveolar membrane", and (2) the total resistance to O_2 diffusion is located in the interior of the erythrocytes. Examination of the factors determining the alveolar-endcapillary O_2 pressure difference and the O_2 diffusing capacity discloses major differences in the mode of O_2 tension equilibration if the erythrocyte concentration is changed.

289
Piiper, J.
[O_2 EXCHANGE IN THE HYPOXIC, ISOLATED DOG'S LUNG DURING VARIATIONS OF THE ERYTHROCYTE CONCENTRATION AND CIRCULATION] O_2-Austausch der isolierten Hundelunge im hypoxischen Bereich bei Veränderungen der Erythrocytenkonzentration und der Durchblutung. —— Pflügers Archiv für die gesamte Physiologie (Berlin), 275 (2): 193-214. 1962. In German, with English summary (p. 211-212).

Alveolar gas exchange was measured in the hypoxic area in 18 isolated lung lobes of the dog, perfused with blood from donor animals. In 5 experiments the red cell concentration of the perfusion blood was varied, in 13 experiments the perfusion rate was changed. The venous and the alveolar O_2 pressures were kept nearly constant. By variations of the erythrocyte concentration in the perfusion blood the alveolar-arterial O_2 pressure difference was not changed, whereas the calculated O_2 diffusing capacity was nearly proportional to the erythrocyte concentration. Changes in the perfusion rate did not alter the alveolar-arterial O_2 pressure difference, while the resulting O_2 diffusing capacity turned out to be very nearly proportional to the perfusion rate. Two possible interpretations of these results are considered. (From the author's summary)

290
Piiper, J.
[ALVEOLAR-ARTERIAL OXYGEN PRESSURE EQUILIBRIUM IN THE HYPEROXIC ISOLATED DOG'S LUNG] Die alveolär-arterielle O_2-Druckangleichung in Hyperoxie an der isolierten Hundelunge. — Pflügers Archiv für die gesamte Physiologie (Berlin), 275 (2): 215-227. 1962. In German, with English summary (p. 225-226).

The alveolar-arterial O_2 pressure difference (AaD) was examined at an alveolar O_2 pressure of 300 mm. Hg using isolated lung lobes perfused with blood from donor dogs. Changes in the arterio-venous O_2 difference, produced by alternate perfusion with arterial and venous blood, had no effect on the AaD. Change of the O_2 pressure on the surface of the lung lobe from a value equal to that in the alveolar gas (300 mm. Hg) to values which corresponded to normal venous O_2 pressure (37 mm. Hg) had no effect on the AaD if the lung was perfused with arterial blood, or increased it slightly if venous blood was used. The perfusion rate did not affect the AaD significantly. (From the author's summary)

291
Priban, I. P.
AN ANALYSIS OF SOME SHORT-TERM PATTERNS OF BREATHING IN MAN AT REST. —Jour. Physiol. (London), 166 (3): 425-434. May 1963.

Spirograms from normal subjects show small short-term recurring changes in tidal volume (V_T) and respiratory frequency (f) which were investigated. The simultaneously obtained values of V_T and f are negatively correlated so that their product, the average minute volume per breath, is relatively constant. The number of short-term changes in breathing is less than would be expected from a random process and the average length of a "run" (defined as one or a sequence of increasing or decreasing values of respiratory frequency) is 1.795 breaths while the average length of run expected from a random process is 1.503 breaths. Duplicate measurements on four subjects show that the average length of run does not vary much between experiments on any one individual, but varies significantly between individuals. Comparative measurements made during carbon dioxide-induced hyperpnea show that the number of breaths per run is unchanged when V_T and f are increasing. The findings suggest the existence of a respiratory control mechanism in which a controlling factor is related to a function of breathing and which may actively regulate V_T and f for any given level of ventilation. (From the author's summary)

292
Raine, J. M.,
and J. M. Bishop
A-a DIFFERENCE IN O_2 TENSION AND PHYSIOLOGICAL DEAD SPACE IN NORMAL MAN. — Jour. Applied Physiol., 18 (2): 284-288. March 1963.

Alveolar-arterial difference in oxygen tension (A-aD) and physiological dead space/tidal volume ratio (VD/VT) were measured in normal subjects aged 17-66 years, in the supine and sitting postures. Alveolar oxygen tension (Pa_{O_2}) decreased and A-aD increased with age. A-aD was not affected by posture, but increased with arterial oxygen tension (PA_{O_2}). Regression equations relating Pa_{O_2} and A-aD to age, and PA_{O_2} were calculated. VD/VT increased with age in the supine position, but when sitting the increase with age was small and barely significant. Consequently, although VD/VT was greater when sitting than when supine in young subjects, there was no such difference in the older subjects. Possible reasons for the effect of age and body position are discussed. (Authors' abstract)

293
Schmidt, K.,
and J. Seusing
[THE INFLUENCE OF GAS DENSITY ON THE GAS EXCHANGE BETWEEN THE ALVEOLAR SPACE AND THE DEAD SPACE] Der Einfluss der Gasdichte auf den Gasaustausch zwischen Alveolarraum und Totraum—Internationale Zeitschrift für angewandte Physiologie (Berlin), 20 (1): 34-37. 1963. In German.

Six subjects inspired helium and/or argon-oxygen mixtures in the ratio of 80:20 within a closed spirometric system. During the respiration of each gas mixture the subjects were directed to make apneic pauses of varying length before expiration. Continuous registrations were made of the expired gas volume and the CO_2 percent in the expired gas mixture together with pneumotachographic readings. The results show a faster diffusion of CO_2 from the alveolar space to dead space during respiration with the lighter helium-oxygen mixture as compared to the heavier argon-oxygen mixture. The improvement of alveolar ventilation during respiration with lighter gas mixtures as compared to normal air is therefore based not only on the lowering of the turbulent resistance in the respiratory passages but also on facilitation of the diffusion processes between the alveolar space and the dead space.

294
Sergeev, N. P.
[CHANGES IN CARBONIC ANHYDRASE ACTIVITY AFTER HYPERVENTILATION IN HUMANS] Izmenenie aktivnosti ugol'noi angidrazy u liudei posle giperventiliatsii.—Fiziologicheskii zhurnal SSSR (Moskva), 48 (11): 1399-1403. 1962. In Russian.

Carbonic anhydrase levels in the blood were determined in 52 subjects before and after hyperventilation. In all subjects, a short increase in carbonic anhydrase activity was observed after a 3-minute period of active hyperventilation. Splenotomy, as evidenced by one case, did not influence carbon anhydrase activity after a 3-minute period of hyperventilation.

295
Spiegel, M. V.
[THE BRONCHIAL RESPIRATORY RESISTANCE AT INCREASED PRESSURE]—Die bronchialen Strömungswiderstände bei Überdruct. Zeitschrift für klinische Medizin (Berlin), 157 (5): 405-419. 1963. In German with English summary (p. 418-419.

The changes in viscous and elastic respiratory resistance by increasing external pressure were investigated with ten healthy male subjects. A high-pressure chamber was used with test-gas mixtures of 90% nitrogen and 10% oxygen, and 90% helium and 10% oxygen. The respiratory resistance was recorded by a pneumotachograph and the esophageal pressure measurement at the simulated depths of 10, 25, 50, 100, and 150 m. of water. With increasing pressure the respiratory resistance was increased, whereby the major component was contributed by the viscous resistance. Correspondingly the viscous respiratory work increased with rising external pressure. The resistance to gas flow for individual gases begins at a level which is determined by the molecular weight of the gas and rises with increasing pressure. At a given depth, beginning with 0 meters, the resistance is higher, the heavier the gas used. (Author's summary, modified)

296
Stone, D. J.
RESPIRATION IN MAN DURING METABOLIC ALKALOSIS. ——Jour. Applied Physiol., 17 (1): 33-37. Jan. 1962.

A steady state metabolic alkalosis was induced in two subjects over a period of several days utilizing oral sodium bicarbonate in dosages of 50 g./day. The experiment was so designed that the arterial pH in both subjects tended to return toward normal in the presence of significant increases in blood bicarbonate. Repeated study of ventilation responses with room air and 4% and 6% carbon dioxide in inspired air revealed a definite and significant decrease in ventilation response to carbon dioxide during the periods of steady state alkalosis as compared to the control periods. Normal responses returned after some time lag. A consistent rise in arterial CO_2 tension occurred with alkalosis, thus demonstrating respiratory compensation. In neither subject was total lung function or gas exchange affected by the alkalosis. The experiment was confirmed on several occasions with reproducible results. (From the author's abstract)

297
Strömme, J. H.,
and J. Fog
EFFECT OF ACETAZOLAMIDE ON RESPIRATORY GAS EXCHANGE DURING HYPERVENTILATION IN MAN. ——Jour. Applied Physiol., 17 (1): 6-8. Jan. 1962.

Nine healthy men were given acetazolamide orally in doses of 10-12 mg./kg. body weight. All showed a decrease in carbon dioxide output during hyperventilation performed 2 hours after the dosage as compared to values obtained in tests without premedication. The mean reduction was about 12%. During these tests no significant change was recorded in the oxygen uptake. The decreased output of carbon dioxide is presumed to be caused by an inhibition by acetazolamide of the carbonic anhydrase present in the erythrocytes. (From the authors' abstract)

298
Stucki, R.
[EFFECT OF RESPIRATORY FREQUENCY ON THE ANATOMIC AND ALVEOLAR DEAD SPACE OF THE DOG] Influence de la fréquence respiratoire sur les espaces morts anatomique et alveolaire du chien.—Helvetica physiologica et pharmacologica acta (Basel), 21 (1): 27-38. 1963. In French, with English summary (p. 37).

In 12 narcotized, artifically ventilated dogs, respiratory frequency varied from 10 to 40 cycles/minute under conditions when tidal volume, mean tracheal pressure and alveolar gas tensions were maintained constant. Inspiratory and end-alveolar oxygen and carbon dioxide pressures were measured simultaneously with oxygen and carbon dioxide tensions in arterial blood. Anatomical dead space was determined by the Fowler method and alveolar dead space by analysis of the alveolar-arterial carbon dioxide pressure difference. Both anatomical and alveolar dead space increased with respiratory frequency: when it varied from 13 to 32 cycles/minute, the anatomical dead space increased by 22% (from 138 to 168 ml.) and the alveolar dead space by 38% (from 29 to 40 ml.). (Author's summary, modified)

299
Sugioka, K.,
D. A. Davis, M. Hinternhoff, R. L. McKnight, and D. C. Grosskreutz
OXYGEN AND CARBON DIOXIDE TENSIONS AS FACTORS IN RESPIRATION AFTER APNEA FROM HYPERVENTILATION. —— Anesthesiology, 23 (6, Part 1): 776-782. Nov. 1962.

Dogs were lightly anesthetized with pentobarbitol and ventilated with room air, or anesthetized with ether and ventilated with a 25% oxygen mixture. Continuous recordings were made of oxygen (Po_2) and carbon dioxide tensions (Pco_2), blood pressure, and respiratory flow, during and after hyperventilation. Hyperventilation resulted in increased arterial oxygen tension which remained consistently high while arterial carbon dioxide tension fell to very low levels. The resumption of respiration following the apnea of hyperventilation occurred when the oxygen tension dropped to low levels and at low Pco_2 and seems independent of Pco_2 at that time. The initiation of respiration after this form of apnea is possibly a function of the hypoxic drive from the aortic and carotid body chemoreceptors rather than an effect of carbon dioxide on the respiratory center. Dangerous levels of hypoxia may occur during apnea after hyperventilation with gas mixtures containing 20-25% oxygen if respiratory assistance is not given in the interval between the onset of apnea and the resumption of respiration from whatever stimulus initiates breathing at this time. (Authors' summary, modified)

300
Tomashefski, J. F.,
E. T. Carter, and J. A. Lipsky
CARBON DIOXIDE AND ACID-BASE TRANSIENTS DURING HYPERVENTILATION. —— Jour. Applied Physiol., 17 (2): 228-232. March 1962.

Studies were conducted on ten healthy adult males subjected to mechanically induced hyperventilation. Total ventilation was increased approximately 300%. This resulted in a mean arterial carbon dioxide tension decrease to 20 mm. Hg. and a mean pH increase to 7.60. Observations of the dynamic shifts in carbon dioxide stores were made for a 12-minute period after onset of hyperventilation. The total carbon dioxide elimination was determined and compared to the basic metabolic carbon dioxide production to permit estimation of body carbon dioxide depletion. The total carbon dioxide elimination was partitioned into that coming from the tissues, the blood, the lung parenchyma, and the alveolar air. After the abrupt increase in alveolar ventilation, a significant portion of the expired carbon dioxide comes from the lung tissue store and the alveolar gas compartments; this is approximately 140 cc. and is eliminated in the first 3 minutes. After 3 minutes most of the expired carbon dioxide can be accounted for as coming from blood and tissues. (Authors' abstract)

301
Vacek, A.,
and F. Ševčík
ELECTROCHEMICAL DETERMINATION OF THE TENSION OF OXYGEN IN TISSUE.—Physiologia bohemoslovenica (Praha), 12 (3): 269-274. 1963

An electrochemical method for determining oxygen tension in various tissues has been elaborated using rectangular polarizing pulses, the current being measured at their termination. Polarization of the electrodes for 5 seconds is sufficiently long for obtaining reproducible values in vitro and in vivo. This method makes it possible to determine oxygen tension from 11 points at one-minute intervals for prolonged length of time. The apparatus is fitted with a remote control unit. (Authors' summary)

302
West, J. B.
REGIONAL DIFFERENCES IN GAS EXCHANGE IN THE LUNG OF ERECT MAN. —— Jour. Applied Physiol., 17 (6): 893-898. Nov. 1962.

Measurements of regional ventilation and blood flow using radioactive carbon dioxide show that both increase from apex to base of the lung. Ventilation-perfusion ratios at nine levels of the lung have been calculated and differences in local gas exchange deduced. In the resulting model, alveolar oxygen tension changes by more than 40 mm. Hg from apex to base while carbon dioxide and nitrogen tensions change by about 14 and 29 mm. Hg, respectively. Maximal differences in oxygen saturation of end-capillary blood are 4% but differences in carbon dioxide contents of 7 vol.% and pH variations of 0.12 units occur. The oxygen uptake per unit lung volume increases eightfold down the lung while corresponding variations in carbon dioxide output are less than threefold. Nitrogen passes out of the blood in upper parts of the lung but into the blood in basal regions (net exchange is zero). Over-all oxygen uptake and carbon dioxide outputs are reduced by only 2-3% by the ventilation-perfusion ratio inequality, causing alveolar-arterial differences of 4, 1, and 3 mm. Hg for oxygen, carbon dioxide, and nitrogen, respectively. (Author's abstract)

303
Widdicombe, J. G.,
and J. A. Nadel
AIRWAY VOLUME, AIRWAY RESISTANCE, AND WORK AND FORCE OF BREATHING: THEORY.— Jour. Applied Physiol., 18 (5): 863-868. Sept. 1963.

Equations for optimal frequencies of breathing at which mechanical work and mean inspiratory force are minimal and which assume dead space and resistance are constant ignore possible changes in airway caliber. An inverse relationship between resistance and dead space was assumed and a series of curves were plotted relating mechanical work and mean inspiratory force to frequency of breathing for various dead spaces and corresponding resistances. As dead space increases, the levels of work and inspiratory force fall to minima, then rise; the frequencies at which work and force are minimal increase, then decrease. Adding a series resistance or dead space, changing the resistance/dead space relationship, decreasing lung compliance, or increasing alveolar ventilation do not alter the general shapes of the curves, but change the values of optimal dead space. The optimal dead spaces for minimal work (0.125 liter) and for minimal inspiratory force (0.14 liter) lie within the normal range. Nervously mediated airway tone in healthy subjects may represent optimal adjustment of airway caliber. (Authors' abstract)

304
Young, A. C.,
C. J. Martin, and W. R. Pace
EFFECT OF EXPIRATORY FLOW PATTERNS ON LUNG EMPTYING. —— Jour. Applied Physiol., 18 (1): 47-50. Jan. 1963.

Differences in expired alveolar gas concentrations with changes in expiratory flow were studied in single-breath experiments using nitrogen and carbon dioxide meters. High flow rates preferentially emptied lung areas having low ventilation-to-volume ratios and high ventilation-to-perfusion ratios, whereas low flow rates preferentially emptied areas of high ventilation-to-volume and low ventilation-to-perfusion ratios. Selective emptying of different lung areas by varying the expiratory flow pattern was not affected by age, sex, or body position. A model of the lung is proposed to explain how ventilation-to-volume ratio differences can be seen at mouth level during constant slow, varying, and constantly increasing or decreasing expiratory flow. (Authors' abstract)

d. Metabolism

305
Berloco, N.,
F. Caspani, and C. Masserini
[RELATIONSHIP BETWEEN MUSCULAR ACTIVITY AND RESPIRATORY FUNCTION IN HEALTHY SUBJECTS OF DIFFERENT AGES. I. OXYGEN CONSUMPTION] Rapporti tra attività muscolare e funzi-

one respiratoria nei soggetti sani di differente età. I. L'assorbimento di ossigeno. —— Giornale italiano della tubercolosi e delle malattie del torace (Milano), 16 (3): 101-104. May-June 1962. In Italian.

In a group of 120 healthy subjects in the age ranges of 7-15 years (scholastic), 21-31 years (young), and 64-75 years (old) the oxygen consumption was measured under aerobic and anaerobic conditions while the subjects performed varying degrees of muscular work. Oxygen consumption under aerobic conditions increased proportionately with the increase in the degree of work. It did not differ statistically between the three groups, the maximum variation being 12%. Muscular activity performed by individuals of scholastic and old ages presented a lower oxygen consumption than that of young subjects. During elevated muscular activity under anaerobic conditions the oxygen consumption decreased. During work, oxygen consumption does not appear to be influenced by age but by the conditions of aerobiosis.

306
Krasnova, A. F.,
and N. R. Chagovets
[EFFECTS OF MALT EXTRACT INGESTION UPON BIOCHEMICAL CHANGES IN THE BLOOD OF ATHLETES DURING MUSCULAR EXERTION] Vliianie priema solodovogo ekstrakta na biokhimicheskie izmeneniia v krovi sportsmenov pri vypolnenii raboty razlichnogo kharaktera.—Voprosy pitaniia (Moskva), 21 (2): 37-39. March-April 1962. In Russian, with English summary (p. 39).

Athletes received a diet of 4125 Cal. supplemented by 100 g. of malt extract (Group I) or the isocaloric amounts of glucose (Group II). Both groups were exposed to physical stress such as cycling for a 6-day period. In the blood of subjects from Group I the level of lactic acid rose by 92% and was accompanied by a rise in the blood sugar level; Group II also showed similar changes in the blood, however, they were not as marked as in Group I. It is concluded that the action of maltose contained in the malt extract, while similar to glucose, is more effective in enhancing the aerobic oxidation during muscular exertion.

307
Larson, A. L.,
and H. E. Ederstrom
BLOOD GLUCOSE CHANGES INDUCED BY COLD, EPINEPHRINE, AND NOREPINEPHRINE IN DOGS OF VARIOUS AGES. —— Proc. Soc. Exper. Biol. and Med., 110 (1): 131-134. May 1962.

Under the age of 5 days newborn dogs did not have a hyperglycemic response to cold exposure for one hour, while pups older than this, as well as adults, showed a significant rise in blood glucose. Epinephrine alone or combined with cold exposure produced a hyperglycemic effect in dogs of all ages, but the response was considerably lower in dogs under 5 days. Norepinephrine had a small and variable effect on blood glucose. The combination of norepinephrine with cold gave a somewhat larger and more consistent hyperglycemia, except in the youngest dogs, which had a hypoglycemic response. Dogs under 8 days had greater depression of rectal temperature in the cold after epinephrine than after saline or norepinephrine administration. In none of the animals did the calorigenic effects of the amines increase cold resistance, as indicated by rectal temperature changes. (Authors' summary)

308
Liddell, F. D. K.
ESTIMATION OF ENERGY EXPENDITURE FROM EXPIRED AIR. —— Jour. Applied Physiol., 18 (1): 25-29. Jan. 1963.

Short-cut methods of estimating energy expenditure from pulmonary ventilation are examined. Although for any one subject carrying out a particular task, the relationship between his energy expenditure and his ventilation is approximately linear, the equation of the regression line differs from task to task and, for any particular task, from subject to subject. Thus, the estimation of energy expenditure, for the generality of subjects and tasks, from pulmonary ventilation alone, by application of a single simple formula, is seen to be unacceptable as the estimates could be subject to serious error. Analysis of expired air cannot, therefore, be dispensed with but the calculations for estimating energy expenditure in terms of ventilation and the analysis of the expired air, already simplified by Weir, are shown to be even further reducible. A nomogram by which they can be carried out with negligible error is presented. (Author's abstract)

309
Logatkin, M. N.
[SOME PECULIARITIES COMMON TO THE UTILIZATION OF ENDOGENOUS FAT IN PARTIAL FASTING AND PHYSICAL LOADING] Nekotorye osobennosti utilizatsii endogennogo zhira pri chastichnom golodanii i fizicheskoi nagruzke.—Voprosy pitaniia (Moskva), 22 (5): 27-34. Sept.-Oct. 1963. In Russian, with English summary (p. 34).

Experimental work with 10 subjects over a ten-year period furnished the basic research on the regulation of utilization of body fat stores and the excretion of incompletely oxidized metabolites in the urine during partial fasting (400, 700, 900, and 1000 Cal. per day). Certain relationships were disclosed among appearance of ketone compounds in the urine, the degree and uniformity of the physical load, the caloric value of the food, and the carbohydrate intake. The minimum amount of carbohydrates to prevent ketonuria in low-calory nutrition with moderate physical work was established. The processes responsible for the appearance of incompletely oxidized metabolites in the urine common to many conditions (hypoxia, fever, over-cooling, fasting, etc.) are described.

310
Malhotra, M. S.,
S. S. Ramaswamy, and S. N. Ray
INFLUENCE OF BODY WEIGHT ON ENERGY EXPENDITURE. —— Jour. Applied Physiol., 17 (3): 433-435. May 1962.

Energy expenditure in a group of 58 adult male subjects has been studied for marching, rifle drill, parade, physical training, bayonet fighting, cycling, sitting, and standing, using the method of indirect calorimetry. For all these tasks a linear relationship between energy expenditure and body weight has been established. (Authors' abstract)

311
Malhotra, M. S.,
J. S. Gupta, and R. M. Rai
PULSE COUNT AS A MEASURE OF ENERGY EXPENDITURE.—Jour. Applied Physiol., 18 (5): 994-996. Sept. 1963.

Studies were made on seven subjects who were given different grades of exercise on a bicycle ergometer with a workload varying from 50 to 600 kg.-meters/minute. Calorie expenditure during performance of various tasks was calculated by collecting the expired gases during the steady state. Pulse rate was also recorded during this period. To estimate the error in using pulse rate for measuring energy expenditure, the same subjects were given various field tasks such as marching, running, hopping, hammering, etc. During performance of these tasks energy expenditure and pulse rate were also measured, using the same techniques. Linear correlation was obtained between the pulse rate and the energy expenditure in all the subjects. There are two components of each curve, one for the pulse rates below 95 and the other for pulse rates above 95. A significant difference was found also in the coefficient of variation for different subjects, showing that separate regression lines are required for each of them. The percentage of error between observed and predicted values of energy expenditure for both the ranges of pulse counts varied from 0.3 to 4.7 and from 0.6 to 7.0, respectively. (Authors' abstract)

312
Rasch, P. J.,
and W. R. Pierson
THE RELATION OF BODY SURFACE AREA, MASS, AND INDICES TO ENERGY EXPENDITURE.—Revue canadienne de biologie (Montreal), 21 (1): 1-6. March 1962. In English.

The relationship of height, weight, calculated lean body mass, fat-free body, body surface area, and various body indices to oxygen consumption was computed for twenty-one adult males. The correlation between oxygen consumption and weight, lean body mass, body surface area, and the Kaupp body index did not differ statistically and was significant at $P<0.1$. The correlations of height, fat-free body, and various indices of body build with oxygen consumption were not statistically significant, indicating that these measures are of little value in the prediction of oxygen consumption. The basic problem underlying area body indices is that they afford no way of distinguishing fat from muscle; hence, two individuals with the same index may have a very different body composition. (Authors' abstract, modified) (25 references)

313
Starka, L.,
and Z. Matys
[THE NORMAL EXCRETION OF INDIVIDUAL 17-KETOSTEROIDS IN THE URINE] Die Normalausscheidung der individuellen 17-Ketosteroide im Harn.—Endokrinologie (Leipzig), 44 (3/4): 156-163. 1963. In German.

Sixty males (age range, 17-62 years) and 26 females (age range, 17-45 years) of normal endocrine status were selected from over 700 cases for determination of the normal diurnal values of excretion of individual 17-ketosteroids. The values were assayed by the fractionation method using paper impregnated with triethylene glycol. The chromatograms were developed repeatedly with different combinations of solvents. The normal values for eight distinct 11-oxygenated corticosteroids and 17-ketosteroids are presented in tables. (27 references)

e. Body Temperature

314
Adams, T.
BODY-TEMPERATURE REGULATION IN THE NORMAL AND COLD-ACCLIMATIZED CAT.—Jour. Applied Physiol., 18 (4): 772-777. July 1963.

The role of the anterior hypothalamus as a temperature-sensible area serving a thermal regulatory input function for body-temperature control in cats living at 25° C. (non-cold-acclimatized) or 5° C. (cold-acclimatized) was tested by selectively changing diencephalic temperatures in the unanesthetized animal resting at 23° C. ambient temperature. Extremity and internal body temperature and metabolic-rate responses were monitored during the induced thermal shifts. Both groups of animals showed greater peripheral vasomotor and internal body-temperature changes consequent to hypothalamic heating than cooling; no modification of these test patterns was noted as a function of whole-body cold acclimatization. The temperature-sensible anterior hypothalamic areas appear to be more influential in protecting against hyperthermia than hypothermia and their function in biothermal control does not appear to be altered by whole-body cold acclimatization. (Author's abstract)

315
Angelakos, E. T.
STUDIES AT MODERATE HYPOTHERMIC TEMPERATURES OF FACTORS AFFECTING SURVIVAL UNDER PROLONGED HYPOTHERMIA.—Boston Univ. School of Medicine, Mass. (Contract AF 33(616)-6767); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722204). Technical Documentary Report no. AMRL-TDR-62-130, Nov. 1962. v+15 p.

The mortality of anesthetized dogs maintained under hypothermia for many hours was studied, and factors responsible for death under these conditions were evaluated. Data are presented on technically successful experiments in 40 dogs maintained at 26±1° C. Among the animals that died during maintained hypothermia, mortality was progressive with no apparent critical time. The median lethal time at 26±1° C. is estimated to be 18 hours. There was a progressive decrease in the average normal pacemaker heart rate in animals maintained at a relatively fixed hypothermic temperature. Values of arterial hematocrit showed a progressive and striking increase during cooling, maintained under hypothermia, and rewarming.

Neither degree of hypothermic acidosis nor plasma electrolyte changes were altered consistently during maintained hypothermia. The factors limiting survival under prolonged hypothermia are different from those involved in the acute induction of the hypothermic state. (Author's abstract)

316
Belding, H. S.,
and B. A. Hertig
SWEATING AND BODY TEMPERATURES FOLLOWING ABRUPT CHANGES IN ENVIRONMENTAL TEMPERATURE. —— Jour. Applied Physiol., 17 (1): 103-106. Jan. 1962.

Human subjects were transferred between environments imposing different levels of heat stress. Analyses of measurements obtained after a reasonably steady state had been achieved in each of several environments revealed equally good correlation between (a) sweat rate and ear temperature (tympanic membrane), and (b) sweat rate and calculated deep skin temperature (hypothetical). The correlations are consistent with adjustment of sweating in response to either hypothalamic temperature or temperature of skin receptors or some combination of the two. However, during the first 20 minutes after transfer, changes in sweat rate and skin temperature occurred together and in the same direction, but were not accompanied by any consistent change in ear temperature. Thus, to the extent that ear temperature represents hypothalamic temperature, an hypothesis of control of sweating based on hypothalamic temperature alone is not tenable. Alternative physiological explanations are given for data developed elsewhere and used in support of an hypothesis of sweat control solely from the hypothalamus. (Authors' abstract)

317
Benziger, T. H.,
C. Kitzinger, and A. W. Pratt
THE HUMAN THERMOSTAT.—In: Temperature—its measurement and control in science and industry, vol. 3 (part 3): 637-665. New York: Reinhold publishing Corp., 1963.

Using cranial instead of rectal measurements of internal temperature and direct and continuous recording methods for the measurement of heat loss (by gradient layer calorimetry) and heat production (from oxygen consumption) the human mechanisms of temperature regulation in warm and cold environments have been resolved in quantitative terms of reproducible stimuli and responses. For both anterior and posterior hypothalamic heat centers, classical theory postulated incoming sensory impulses from the skin and a peculiar power of responding to warm or to cold by changing their response sensitivities to these incoming sensory impulses, warm and cold. The new experimental evidence does not support this complicated view. By calorimetry the anterior center for warm was found not to receive warm-impulses from the skin. By neurosurgery the posterior center for cold, which does not receive and transmit cold-impulses from the skin, was found to be indifferent to temperature and thus unable to modify afferent impulses with temperature. Thus combined calorimetric and neurosurgical evidence leads to one anatomically established organ in the brain, a warm sensor in the anterior hypothalamus below the anterior commissure. (Authors' summary, in part) (97 references)

318
Bernat, R.,
L. Hryniewiecki, and G. Straburzynski
[EFFECT OF SUPERFICIAL HYPOTHERMIA ON SOME NITROGENOUS COMPONENTS AND PROTEINS OF BLOOD SERUM AND LIVER] Wplyw plytkiej hipotermii na niektore skladniki azotowe i bialka surowicy krwi i watroby. —— Acta physiologica polonica (Warszawa), 14 (1): 37-44. 1963. In Polish, with English summary (p. 43).

The effects of superficial hypothermia on the total nitrogen, amino nitrogen, and proteins of blood serum and liver were investigated in 40 guinea pigs, one half of them experimental, and the other controls. Superficial hypothermia of 25° C. was induced by direct 60-minute application of ice. There was a marked rise in the concentration of serum albumins and a decrease in that of serum globulins, especially in the gamma fraction. In the liver there was a decrease of the total nitrogen content and of the fast-moving fractions I, II, and III. No significant changes were revealed in the blood serum and liver amino acids. The disturbances in protein metabolism show that hypothermia has an adverse effect on metabolic processes. (Authors' summary, modified)

319
Blozovski, D.,
and M. Blozovski
[ELECTROENCEPHALOGRAM OF THE YOUNG ANIMAL DURING HYPOTHERMIA AND HYPERTHERMIA]—Électrocorticogramme du jeune animal sous hypothermie et sous hyperthermie. Journal de physiologie (Paris), 55 (2): 115-116. March-April 1963. In French.

Electroencephalographic studies were made in young and adult rabbits and chickens during exposure to hypothermia and hyperthermia. During hypothermia at body temperatures of 25° C. or above, no significant difference was observed between young and adult animals. At lower temperatures the frequency of electrical impulses in both groups was progressively reduced. The restoration of cortical electrical activity during rewarming was proportional to changes in body temperature in young animals, but was delayed in adults. The amplitude and frequency of cortical electrical activity was slightly increased during hyperthermia up to a temperature of 42°. Convulsive activity during hyperthermia was more common in young animals. At 45-46°, the amplitude of electrical impulses was increased, while the frequency decreased until irreversible arrest occurred.

320
Carlson, L. D.
MAINTAINING THE THERMAL BALANCE IN MAN. —— IRE Internat. Convention Record, 1962 (9): 94-102. 1962.

Also issued as: Univ. of Kentucky, Lexington (Contract AF 41(657)-335); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. AAL-TDR-62-24, Jan. 1963. iii+15 p.

Heat production in the human and heat exchange with the environment are characterized with respect to the extent of control and the systems involved in control. The characterizations include: (1) heat production in the core and shell; (2) isotherms in body cooling; (3) temperature regulation; (4) heat loss components of the system; (5) the intensity of thermoregulatory sweating during cold reception in the skin; (6) chemical and physical temperature regulation; (7) input of the neural control system; (8) blood vessels as resistance and capacitance structures; (9) electrical activity related to muscle motion; (10) systems involved in maintaining thermal balance; and (11) the temperature regulation center in the hypothalamus. (Author's summary, in part)

321
Chang, C. B.,
and W. C. Shoemaker
EFFECT OF HYPOTHERMIA ON RED CELL VOLUMES.—Jour. Thoracic and Cardiovascular Surgery, 46 (1): 117-124. July 1963.

A decreased plasma volume and an increased arterial hematocrit after hypothermia was confirmed in a series of dogs. More impressive changes, however, were observed in labeled red cell studies. There was a delayed mixing of injected, labeled red cells, indicating the appearance of a slowly moving volume of red cells. The rapidly circulating red cell volume was calculated using compartmental analysis; this volume was found to be greatly reduced after total body cooling. Only 76% of the animals' red cells were circulating rapidly enough to be mixed with the labeled red cells in the usual 10-minute equilibration period. (From the authors' summary)

322
Chatonnet, J.
NERVOUS CONTROL OF METABOLISM.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 729-730; discussion p. 730-731. May-June 1963.

Nervous control of metabolism for the regulation of body temperature can depend on three kinds of innervation: (1) common commands of somatic motor activity mediated by strengthening the muscular tone and the rate of voluntary muscular activity of shivering; (2) nervous sympathetic commands and adrenomedullary secretion, as estimated in nonacclimated animals by reduction of the maximum metabolism in the cold; and (3) a nervous command specifically designated to a thermoregulatory thermogenesis, which remains hypothetical. The nervous control of heat production is subject to both central and reflex stimuli.

323
Clarke, D. H.,
and J. Royce
RATE OF MUSCLE TENSION DEVELOPMENT AND RELEASE UNDER EXTREME TEMPERATURES.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (5): 330-336. 1962. In English.

Thirty-one male subjects squeezed a hand dynamometer as rapidly and as forcefully as possible, the effort being recorded on fast-moving paper. At the count of three the hand was released explosively. Two such testing sessions were held; following the first measurement of tension development and release the subject immersed his arm in a water bath. On one occasion it was at a temperature of 10° C., on the other occasion at a temperature of 46° C. The subject then repeated the procedure with the hand ergograph. The force-time curves of the contraction were described mathematically by a three-component exponential equation. Very little difference existed in the rate parameters of the normal and hot conditions, but these parameters were markedly slowed by the application of cold. This was further reflected in the contributions that each component made to the total work integral. Similar results were obtained during the release phase; the rates were nearly identical for the normal and hot curves, but two or three times slower for the cold. The steady-state force level, compared with the normal, was significantly increased under the hot condition and significantly depressed under the cold. (Authors' summary and conclusions)

324
Clifford, J. M.
REQUIREMENTS FOR THE THERMAL CONTROL OF A MANIKIN FOR CLOTHING INVESTIGATION. —Revue de médecine aéronautique (Paris), 1 (2): 213-217. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (1): 40-43. Jan. 1963.

A manikin in an ejector seat in a room maintained at 20° C., 15° C., or 10° C., with air movement at 50 feet per minute, wore next to the skin a close-fitting suit knitted from terylene and incorporating a knitted electrical heating wire. The mean skin temperature was constantly monitored and held at 33° C. by adjustment of the current passing through the electrically heated suit. The heat flow characteristics of one region of the body corresponding to a section of the manikin were investigated at the time. The results of these experiments showed an approximately linear relation between heat loss and local skin temperature for each region examined. Included are four representative figures.

325
Connaughton, P. J.,
and F. J. Lewis
HYPOTHERMIA BELOW 25° C. FOR ONE DAY IN THE RAT. —Jour. Applied Physiol., 17 (1): 107-109. Jan. 1962.

Adult rats were subjected to 24 hours of hypothermia at body temperatures below 25° C. Two groups were studied: in one the animals were enclosed in a poorly ventilated Lucite cylinder; the rats in the other group were merely wrapped in a cooling blanket. Those rats cooled while in a poorly ventilated enclosure had a significantly increased survival rate; factors which may have influenced this increased survival are discussed. The changes in hematocrit, respiratory rate, and heart rate parallel those observed previously in the dog subjected to the same procedure. (From the authors' abstract)

326
Covino, B. G.,
D. W. Rennie, S. K. Hong, and B. S. Howell
PHYSICAL ASPECTS OF HUMAN TEMPERATURE REGULATION [Abstract].—International Congress

of Physiological Sciences, 22 (Leiden, 1962), Proceedings, vol. 2, no. 502. Amsterdam [1962?].

As part of a general program in human cold adaptation a comparative study of tissue insulation (I) was carried out in three population groups: (1) American males and females, (2) Alaskan Eskimos, and (3) Korean diving women. The maximal I value, I = (rectal temp.-skin temp.) ÷ skin heat loss, was determined for each subject during immersion in a waterbath of 34-30° C. The I values were then plotted as functions of subcutaneous fat (SF) determined by measuring skinfold thicknesses at 10 representative body areas. At equivalent SF values the three groups had significantly different maximal I values. I values were least in the Eskimos and greatest in the Koreans. The results indicate a spectrum of physical thermoregulatory responses to cold. The high I value of the Koreans, who are repeatedly exposed to cold water, suggests an intensive peripheral vasoconstriction which would tend to prevent a rapid fall in central body temperature during water immersion. The low I value of the Eskimos, whose faces and hands alone are chronically exposed to cold, implies a state of maintained peripheral vasodilatation which would serve as a protective mechanism against local cold injury. In midspectrum are the Americans who are not capable of either extreme of vasomotor response to cold. (Authors' abstract)

327
Craig, F. N.,
and E. G. Cummings
THERMAL INFLUENCE OF SUNSHINE AND CLOTHING ON MEN WALKING IN HUMID HEAT. — Jour. Applied Physiol., 17 (2): 311-316. March 1962.

For two men walking on a treadmill and wearing two layers of permeable clothing, the same physiological strain measured by the rate of increase in mean body temperature could be produced (a) next to a building outdoors in the sunshine with an average air temperature of 85° F. and humidity of 20 mm. Hg and (b) indoors with the same humidity and an air temperature 10° F. higher. Under these conditions, the underwear was mainly wet with sweat and the outer layer was mainly dry. In comparable indoor tests on a third subject, the temperature of the underwear approached equilibrium 1° or 2° F. lower than the temperature of the skin at air temperatures of 85° and 115° F. The error in calculating clothing insulation introduced by assuming the clothing to be dry is determined by the size and direction of the temperature gradient between skin and air. Adding 10° F. to the indoor air temperature does not duplicate all the effects of sunshine. (Authors' abstract)

28
vson, H.,
and E. Spaziani
EFFECT OF HYPOTHERMIA ON CERTAIN ASPECTS OF THE CEREBROSPINAL FLUID. — Exper. Neurol., 6 (2): 118-128. Aug. 1962.

Rabbits were cooled to 25° C. and studied at this temperature. There was no change in the water content or chloride space of the brain after maintaining them for two hours at this temperature. The concentration of chloride in the cerebrospinal fluid was unaltered. The rates of penetration into brain and cerebrospinal fluid of ethyl alcohol, ethyl thiourea, and Na^{24} were compared at normal temperature and 25° C. The marked slowing was attributable primarily to the decreased rate of capillary circulation in the nervous tissue and in the choroid plexuses; the slowing of circulation in the nervous tissue reduced passive diffusion from there to the cerebrospinal fluid, while the slowed circulation to the choroid plexuses reduced the rate of secretion of fluid. (Authors' summary)

329
Dhruva, A. J.,
P. M. Javeri, G. B. Parulkar, and P. K. Sen
MECHANISM OF TEMPERATURE FALL DURING HYPOTHERMIA BY SURFACE COOLING. —Anesthesia and Analgesia, Current Researches, 42 (3): 306-315. May-June 1963.

Mongrel dogs were immersed in a water bath at 4° C. and under various conditions of anesthesia combined with cardioplegia induced by drugs. Seventeen clinical cases involving water-bath immersion at 10 to 14° C. are also reported. Temperature recordings in various organs indicated that heat transfer occured in the intact circulatory system along with conduction across superficial tissues during surface cooling. Temperature lag appeared to be due to the slowness of venous blood in reaching the organs. Afterfall of temperature was shown to be related to pooling of blood due to body position, and to amount of body fat.

330
Dolgova, V.
N. Serafimow, and G. Sestakov.
THYROID HORMONE SYNTHESIS DURING HYPOTHERMIA IN RATS. —Experientia (Basel), 19 (2): 103-104. Feb. 15, 1963.

Radiochromatographic determinations were made of the total uptake of intravenously injected $iodine^{131}$ and the formation of I^{131} compounds in the thyroid glands of rats during a 5-hour period of hypothermia at body temperatures of 18-20° or 28-31° C. Both deep and light hypothermia were found to reduce thyroid iodine uptake and to change the form of thyroid iodine compounds. The ratio of monoiodotyrosine and diiodotyrosine to total iodine was increased during hypothermia, while triiodothyronine and thyroxine were absent. It is suggested that hypothermia results in a blockade of the enzyme reactions involved in the last phases of hormone synthesis, probably the coupling of iodinated tyrosines. The absence of iodinated thyronines and higher values of iodinated tyrosines indicates a more severe effect of hypothermia on this system than on the other enzymes of thyroid hormone synthesis.

331
Drucker, W. R.,
B. Kingsbury, and L. Graham
THE EFFECT OF HYPOTHERMIA ON INTERMEDIARY METABOLISM. — Metabolism, 11 (10): 1087-1097. Oct. 1962.

Mean arterial blood pressure fell in dogs during induction of hypothermia (30° C.) by surface cooling, but gradually rose thereafter. Plasma volume and arterial pH continued to fall and rose only with rewarming. During hypothermia the spontaneous respiratory rate decreased to 4-6 per minute, but there was no accumulation of inorganic phosphorus or calculated excess lactate indicative of tissue anoxia. On the contrary, blood lactic acid and glucose fell significantly with prolonged hypothermia, but returned to control levels with rewarming. The fall in pH was ascribed to a respiratory rather than a metabolic acidosis. The results indicated that 4 hours of hypothermia at 30° C. did not cause a disparity between tissue oxygen supply and the amount of oxygen required by the energy yielding processes of the cells. (Authors' summary, modified)

332
Emiroğlu, F.,
N. Gökhan, and E. Çirpili
THE SENSITIVITY OF CHEMORECEPTORS OF THE DOG DURING PROGRESSIVE HYPOTHERMIA. — Archives internationales de physiologie et de biochimie (Liège), 70 (1): 41-48. Feb. 1962. In English.

An increased discharge of the sinus nerve chemoreceptors was observed in dogs rendered hypoxic by breathing a mixture of 5-10% oxygen in nitrogen at various stages of hypothermia induced by immersion in ice-water baths. The onset of the response to hypoxia was somewhat delayed in hypothermic animals when compared to similarly treated normothermic ones. On the basis of these results, the depression of respiration in hypothermia cannot be attributed to any alterations in the excitability of the peripheral nervous mechanisms concerned.

333
Essman, W. B.,
and F. N. Sudak
EFFECT OF BODY TEMPERATURE REDUCTION ON RESPONSE ACQUISITION IN MICE. — Jour. Applied Physiol., 17 (1): 113-116. Jan. 1962.

In four experiments designed to determine the effects of a moderate reduction of body temperature on response acquisition mice were treated with either 2,4-dichlorophenoxyacetic acid or saline in combination with cold exposure. In a four-trial water-escape problem, normothermic animals acquired the response but hypothermic mice did not show learning. A temperature-dependent relationship to learning was demonstrated. (Authors' abstract)

334
Essman, W. B., 1963
and F. N. Sudak
EFFECT OF HYPOTHERMIA ON THE ESTABLISHMENT OF A CONDITIONED AVOIDANCE RESPONSE IN MICE. — Jour. Compar. and Physiol. Psychol., 56 (2): 366-369. April 1963.

In two experiments investigating effect of moderate hypothermia on establishment of conditioned avoidance responses, and upon response to electric shock, an average reduction of body temperature by 2.8° C. was capable of impairing acquisition. Escape from electric shock was unimpaired at a greater degree of hypothermia than was required for impairment of acquisition. It was concluded that: (a) responses reinforced with a single punishing shock were not conditioned in hypothermic mice, whereas normothermic mice demonstrated conditioning under identical training conditions; (b) an escape response to 3.8 ma. shock remains unaffected at colonic temperatures reduced by as much as 9.3° C.; (c) minimal hypothermia (2.8° C.) may interfere with acquisition of a response rather than with retention of a response presumably acquired under hypothermia. (Authors' summary)

335
Essman, W. B.,
and F. N. Sudak
SUSTAINED AND TEMPORARY HYPOTHERMIA AS VARIABLES IN SUCCESSFUL MAZE LEARNING. — Psychol. Reports, 10 (2): 551-557. April 1962.

Two experiments are described in which the acquisition of a simple sensorimotor water maze habit was studied as a function of body temperature reduction during acquisition training. When moderate hypothermia was maintained in mice throughout the three acquisition trials, learning did not occur, whereas, when body temperature was temporarily reduced (within 2° of normothermia) and raised during the intertrial interval to initial temperatures, learning did occur. The suggestion that moderate sustained hypothermia interferes with the consolidation of experience, thus not allowing for learning, was considered. Implications of the present findings as far as hypothermia, motivational properties of water-escape, and temperature reduction in relation to other independent variables are discussed. (Authors' summary, modified)

336
Fox, R. H.,
R. Goldsmith, I. F. G. Hampton, and R. T. Wilkinson
THE EFFECTS OF A RAISED BODY TEMPERATURE ON THE PERFORMANCE OF MENTAL TASKS [Abstract].—Jour. Physiol. (London), 167 (1): 22P-23P. June 1963.

Mental performance was compared in subjects at normal and at three raised levels of body temperature (37.3°, 37.9° and 38.5° C.). The effects of each temperature level were tested once during each of the four replicated periods of four days. The results showed that when body temperature was elevated to 38.5° C., both speed and accuracy in mathematics was impaired ($P < 0.02$) whereas vigilance was improved ($P < 0.05$). In the accuracy of mathematics and in vigilance a similar trend was seen at the two lower body temperatures. The subjects became heat-acclimatized but the effects of an elevated body temperature on mental performance did not diminish as acclimatization developed. It is concluded that raising body temperature does directly affect mental performance and the change observed may be either an improvement or impairment of performance depending on the type of test and the conditions of testing used. (Authors' abstract, modified)

337
Frankel, H. M.,
J. P. Ellis, and S. M. Cain
DEVELOPMENT OF TISSUE HYPOXIA DURING PROGRESSIVE HYPERTHERMIA IN DOGS.—Amer. Jour. Physiol., 205 (4): 733-737. Oct. 1963.

Heart rate, mean arterial pressure, respiratory rate, minute volume, arterial blood oxygen tension (P_{O_2}), carbon dioxide tension (P_{CO_2}), pH, hemoglobin saturation, lactic acid, and pyruvic acid were determined on anesthetized dogs during progressive hyperthermia. Heart rate increased as rectal temperature (T) increased. Mean arterial pressure began to decline at T between 41° and 42° C. Respiratory rate and minute volume reached maximum values at temperatures around 42° C. Arterial P_{O_2} and hemoglobin saturation did not decrease until rectal temperature exceeded 42° C. P_{CO_2} decreased and pH increased from control values as minute volume increased. Arterial excess lactate showed the most marked rise at T between 41° and 42° C. Failure of external respiration is not the primary physiological failure during progressive hyperthermia but the development of tissue hypoxia may be. (Authors' abstract)

338
Frommel, E.,
C. Fleury, I. von Ledebur, and M. Beguin
ON THE DIFFERENTIAL MOBILISATION OF ADRENALIN AND CORTISONE IN THE PROGRESS OF STRESS UNDER HYPOTHERMIC CONDITIONS OF EXTERNAL CAUSE AND OF VACCINE FEVER. —Medicina experimentalis (Basel), 6 (4): 261-264. 1962. In English.

Sudden hypothermia in guinea pigs, due to refrigeration for 3 hours at an air temperature of -13°±2° C., mobilizes adrenaline with an ephemeral action and brief duration. Hypothermia of this type diminishes the sleep duration induced by a standard oral dose of phenobarbital (30 milligrams/kilogram body weight). The use of cortisone counteracts this effect of hypothermia. (Authors' summary, modified)

339
Fuhrman, G. J.,
and F. A. Fuhrman
UTILIZATION OF GLUCOSE BY THE HYPOTHERMIC RAT.—Amer. Jour. Physiol., 205 (1): 181-183. July 1963.

Hyperglycemia of several hours duration was shown to occur in fasted rats given a small glucose load at a body temperature of 18°C. To eliminate the possibility that continued formation of glucose from glycogen produced the hyperglycemia, carbohydrate balance studies were made. The glycogen in the livers of cooled rats was the same with and without a glucose load, indicating a failure in ability to store glycogen. After injection of C^{14}-labeled glucose into hypothermic rats, the specific activity of glucose in the plasma remained constant for two and one half hours. This is further evidence that endogenous glucose is not added to the extracellular phase during hypothermia. The rate of uptake of glucose by muscle was measured at 38° and 18°C., and these results compared with those obtained in the whole animal. Removal of glucose from the blood is far slower than expected from physical-chemical effects of temperature. Failure to convert glucose to glycogen may be the cause of the hyperglycemia in hypothermia. (Authors' abstract)

340
Glebova, N. F.
[THE INVOLVEMENT OF VENOUS THERMORECEPTORS IN CHEMICAL THERMOREGULATION] Uchastie termoretseptorov ven v khimicheskoi termoreguliatsii.—Doklady Akademii Nauk SSSR (Moskva), 149 (3): 742-745. 1963. In Russian.

Doses of Ringer's solution of various temperatures were injected at intervals into the excised thoracoepigastric vein of rabbits. The animals were kept in a thermostat and their oxygen consumption was measured. The oxygen consumption increased when the temperature of the perfusion medium was 12-25° C. and decreased when the temperature was 28-40° C. In six isolated instances the warm solution (41-44° C.) caused an increase in oxygen consumption probably due to the onset of hyperthermic reaction. The electromyographs were normal when the temperature of the solution was 35° C., but at 20° C. there was a marked increase in low-voltage impulses. It is concluded that venous chemoreceptors are involved in both physical and chemical thermoregulation.

341
Gökhan, N.,
and E. T. Angelakos
ELECTROENCEPHALOGRAPHIC ACTIVITY AFTER CIRCULATORY ARREST IN THE HYPOTHERMIC DOG. — Jour. Applied Physiol., 18 (1): 69-72. Jan. 1963.

Determinations were made in dogs of the time lapse between occlusion of venae cavae and electrical silence in the electroencephalograph (EEG) at several hypothermic temperatures. Moderate hypothermia appeared to have a protective effect on the electrical activity of the brain after circulatory arrest. The time lapse was found to be longest near 28° C. At lower temperatures cooling had a gradually increasing direct depressant effect on brain cell activity, and the time lapse between occlusion and EEG silence was shortened. However, near 22° C. it was still longer than at normothermic temperatures. EEG activity virtually ceased at brain temperatures of 20-18° C. The results are interpreted on the basis of a depressant effect of hypothermia on the metabolic rate of the brain and a correlation between metabolic rate and EEG activity. (Authors' abstract)

342
Hall, F. G.,
and J. V. Salzano
CARDIOPULMONARY RESPONSES TO HYPOTHERMIA AND CERTAIN OTHER ENVIRONMENTAL STRESSES.—Duke Univ. Medical Center, Durham, N. C. (Contract AF 33(616)-6803); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7163,

Task no. 716301). Technical Documentary Report no. AMRL-TDR-63-19, March 1963. iii+49 p.

Respiratory regulation was studied at normal and sub-normal body temperatures, Hypoxia and body temperature were found to operate reciprocally in determining utilization of oxygen in a closed environment. Respiratory and circulatory responses to imposed tracheal obstruction were studied in normothermic and hypothermic anesthetized animals. These responses were found to be related to the degree of hypoxia which developed rather than to body temperature, per se. Changes in anatomical and physiological dead space were also measured during reduction of body temperature. There were only small changes in respiratory dead space. No significant impairment of gas transport occurred at body temperatures as low as 28° C. Reflex activity was also studied in normothermic and hypothermic animals. Hypothermic animals retain reflec activity but the magnitude of the responses is less than at normal body temperature. The augmented response to norepinephrine was greater than that for epinephrine during reduction in body temperature to 28° C. Vagal reflexes also operate at body temperatures as low as 28° C. It was found animals respond to carbon dioxide stress essentially in the same manner in the hypothermic as in the normothermic state but at a lower order of magnitude. (Authors' abstract) (31 references)

343
Hammel, H. T.,
D. C. Jackson, J. A. J. Stolwijk, and J. D. Hardy
HYPOTHALAMIC TEMPERATURES IN DOG AND MONKEY AND THERMOREGULATORY RESPONSES TO ENVIRONMENTAL FACTORS.—John B. Pierce Foundation, Inc., New Haven, Conn. (Contract AF 33(657)-7603); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722204). Technical Documentary Report no. AMRL-TDR-63-5, Jan. 1963. iii+30 p.

The role of the hypothalamic and skin temperatures in controlling the thermal response of a resting animal was studied by measuring (1) hypothalamic, rectal, ear skin, and trunk skin temperatures on the resting dog and rhesus monkey (hypothalamic temperature only) in hot, neutral, and cold environments; and (2) the thermal and metabolic responses of a dog while holding the hypothalamus at approximately 38.7° C. by means of six thermodes surrounding the hypothalamus and perfused with water. The results indicate that the parameters involved in temperature regulation must include more than skin and hypothalamic temperatures since an animal engaged in normal regulation would exhibit very different responses for the same hypothalamic temperature when exposed to different ambient temperatures or would exhibit the same responses at widely different times, depending on whether asleep or awake. The discussion of these results includes a hypothesis of a dependent set point which suggests that the set point for temperature regulation depends upon the skin temperature, extra-hypothalamic core temperatures, whether the animal is asleep or awake, and other factors. (Authors' abstract)

344
Hannon, J. P.,
and A. M. Larson
FATTY ACID METABOLISM DURING NOREPINEPHRINE-INDUCED THERMOGENESIS IN THE COLD-ACCLIMATIZED RAT. — Amer. Jour. Physiol., 203 (6): 1055-1061. Dec. 1962.

Intravenous infusion of cold-acclimatized rats with l-norepinephrine (2 μg/min.) caused a marked increase in metabolic rate and rectal temperature and a sustained reduction of the respiratory quotient. Prior to infusion the blood and liver concentrations of nonesterified fatty acids (NEFA) were greater in cold-acclimatized than in control rats. Upon infusion blood NEFA levels were markedly increased, but reached the same ultimate concentration in both groups. In vitro studies showed that liver tissue from cold-acclimatized rats had a significantly higher capacity for NEFA (palmitate) oxidation than liver tissue from controls. In vitro studies also showed that epididymal fat tissue from cold-acclimatized rats was considerably more sensitive to NEFA-mobilizing action of norepinephrine than similar tissue from controls. Continuous measurements of respiratory gas exchange during acute cold exposure (5° and -15° C.) of cold-acclimatized rats caused reduction of the respiratory quotient, limited to the transition stage from a lower to higher metabolic steady state. It is concluded that (a) norepinephrine-calorigenesis is primarily supported by oxidation of NEFA; (b) greater calorigenic response to norepinephrine in cold-acclimatized animals is due to improved capacity to form and oxidize NEFA; and (c) norepinephrine is not the sole mediator of nonshivering thermogenesis. We suggest that the calorigenic action of this hormone is either limited to periods of acute cold stress or exerted in conjunction with other neurohumoral agents during chronic exposure. (Authors' abstract)

345
Haynes, J. W.,
and J. M. Maur
A NOTE ON METABOLIC EFFECTS OF SUSTAINED HYPOTHERMIA IN RATS. — Canad. Jour. Biochem. and Physiol. (Ottawa), 40 (10): 1343-1346. Oct. 1962.

Hypothermia was induced in non-fasted rats placed in individual, cylindrical screen cages under crushed ice until a rectal temperature of 15°C. was attained. Hypothermic animals were sacrificed after 0, 30, and 60 minutes' maintenance at this rectal temperature and metabolites were measured in blood and liver. As previously reported, hypothermia caused increases in blood packed cell volume, glucose and lactic acid levels, and plasma levels of inorganic phosphorus and total ketones. Maintenance of hypothermia for 30 or 60 minutes either caused no further change or accentuated the changes observed initially in these metabolites. Liver glycogen level decreased significantly after 30 minutes but returned to almost normal at 60 minutes. Attainment of a "steady state" condition of hypothermia in non-fasted rats did not alter the pattern of metabolic changes observed in acute hypothermia of short duration. (Authors' abstract, modified)

346
Heerd, E.,
and K. Ohara
[INVESTIGATIONS ON THE WATER VAPOR EVAPORATION OF SMALL SKIN AREAS IN MAN. I. DEPENDENCY UPON PARTIAL PRESSURE OF WATER IN THE AMBIENT AIR AT NORMAL SKIN TEMPERATURE] Untersuchungen über die Wasserdampfabgabe kleiner Hautflächen beim Menschen. I. Die Abhängigkeit vom Wasserdampfdruck in der umgebenden Luft bei normaler Hauttemperatur. — Pflügers Archiv für die gesamte Physiologie (Berlin), 276 (1): 32-41. 1962. In German.

Water vapor evaporation of a 10 $cm.^2$ wide area of the inner side of the left lower arm of a male subject was measured by means of an electronic microscale. The skin temperature in this area spontaneously adjusted itself to values between 30° and 34° C. while the rest of the subject's body was in a thermo-indifferent state. Partial pressure of water vapor within the measuring capsule was altered within the range of 3-23 mm. Hg. Water evaporation from the skin as a function of vapor pressure within the capsule may be represented by a straight line bisecting the abscissa at the saturation point of skin temperature. The results suggest that evaporation of water from a small area of the skin is composed in part of a diffusion component and of resting secretion of sweat even in the absence of apocrine or emotional perspiration. (30 references)

347
Ivanov, K. P.
[ON THE PHYSIOLOGICAL MECHANISMS OF CHEMICAL THERMOREGULATION] O fiziologicheskikh mekhanizmakh khimicheskoi termoregulatsii. — Fiziologicheskii zhurnal SSSR (Moskva), 48 (10): 1225-1233. Oct. 1962. In Russian.

Experiments on homoiothermic animals (rabbits and rats) reveal that the electrical activity of resting skeletal muscles appearing during hypothermia is accompanied by weak tonic contractions and insignificant vibrations. The initial increase of the metabolism in the muscles is due to this small vibration that results from the activity of muscle tissue elements, and can occur in the absence of shivering from cold. This vibration is maintained and strengthened by motor nerves.

348
Ivanov, K. P.
ENERGETIC EQUIVALENT OF MUSCLE ACTIVITY DURING THERMOREGULATION.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 737. May-June 1963.

Three types of contractile activity in muscles which provide the source of heat energy during thermoregulation are: motor activity, cold shivering, and thermoregulatory muscle tonus. Contractile muscular activity in the form of cold shivering and thermoregulatory muscle tonus are important as a source of thermoregulation even after cold acclimatization.

349
Jacob, S. W.,
and C. K. Chapman
EFFECTS OF DEEP HYPOTHERMIA ON LEARNED BEHAVIOR. — Surgical Forum, 8: 143-145. 1962.

Rats trained on the Dashiell maze to an asymptotic level of performance were subjected to deep hypothermia. The animal was considered in a state of suspended animation when the intracolonic temperature reached 1° C. This state was maintained for 30 minutes. Re-testing was done at one and two weeks after suspended animation. The running times for the traverse of the maze were increased for both the control and experimental groups; however, the difference was significant only in the group subjected to hypothermia. Eighteen animals were given a second exposure eight weeks after the previous procedure and then re-tested one week later (five rats failed to survive). Running time scores were similar to those observed following a single exposure. Significant error score differences were established. The following interpretations for the error scores are given: (1) the difference in running times may be a function of temporary disability from the stress of the procedure itself; (2) the scores may be a result of stereotyping of previously learned problems following suspended animation; or (3) suspended animation may somehow enhance the ability of the animal to utilize recently learned information.

350
Jendykiewicz, Z.,
W. Rożynek-Łukanowska, G. Straburzyński, and
S. Szulc
[GLUTATHIONE AND ASCORBIC ACID CONTENTS IN BLOOD, MUSCLES, AND LIVER OF GUINEA PIG IN HYPOTHERMIA] Wpływ hipotermii na zawartość glutationu i kwasu askorbinowego we krwi, mięśniach i wątrobie świnki morskiej. — Acta physiologica polonica (Warszawa), 13 (6): 807-813. 1962. In Polish, with English summary (p. 812).

This investigation used sixty guinea pigs divided into a control and an experimental group as subjects. In the experimental group the body temperature was lowered to 16° C. by application of ice. Deep hypothermia raised the glutathione content in blood and muscle and diminished it in the liver. The ascorbic acid content increased in blood, muscles, and liver. These changes confirm observations on the protective action of glutathione and ascorbic acid in deep hypothermia. (Authors' summary, modified)

351
Kahler, R. L.,
A. Goldblatt, and E. Braunwald
CIRCULATORY EFFECTS OF PROFOUND HYPOTHERMIA DURING EXTRACORPOREAL CIRCULATION. — Amer. Jour. Physiol., 202 (3): 523-526. March 1962.

The effects of hypothermia on peripheral vascular resistance, venous return, and systemic blood volume were studied in dogs by the use of extra corporeal circulation at a constant systemic perfusion rate. Cooling to 15-20° C. produced a significant fall in total systemic peripheral vascular resistance and a large augmentation of systemic blood volume. The latter was superimposed on the gradual increase in systemic blood volume which occurs in many dogs on cardiopulmonary bypass. Both systemic vascular resistance and blood volume returned toward control levels during rewarming. Indicator dilution curves demonstrated a decrease in the "actively" circulating blood volume despite the observed increase in total systemic blood volume. These observations suggest that during hypothermia significant arteriolar dilatation occurred and that substantial volumes of blood were "trapped" in the peripheral vascular bed. This trapping resulted in the striking decrease in venous return and increase in systemic blood volume. (Authors' abstract)

352
Kanter, G. S.
BICARBONATE EXCRETION DURING HYPOTHERMIA. —— Canad. Jour. Biochem. and Physiol. (Ottawa), 41 (1): 91-96. Jan. 1963.

The excretion of bicarbonate during hypothermia was studied in five infused (6% creatinine in saline) and five non-infused dogs. The rectal temperature was gradually reduced to the 26-27° C. range by approximately four hours of ice packing. There was no significant increase in bicarbonate excretion during hypothermia in the non-infused group; the urinary pH remained at control levels of about 6.2; the fall in arterial pH was not due to urinary bicarbonate loss. In the infused group, which had a higher urine flow, the urinary pH increased to 6.7 due to increased excretion of bicarbonate. In three animals with highest urine flow, the urine pH approached plasma levels. The excretion rate of bicarbonate in the infused group, however, was similarly insufficient to account for the decrease in arterial pH. The hypothermic kidney is quite effective in reabsorbing bicarbonate. (Author's abstract, modified)

353
Kanter, G. S.
RENAL REGULATION OF BICARBONATE LOADS DURING HYPOTHERMIA.—Albany Medical Coll., Albany, N. Y. (Contract AF 41(657)393); issued by School of Aerospace Medicine. Aerospace Medical Division, Brooks Air Force Base, Tex. (Project no. 7758, Task no. 59587). Technical Documentary Report no. SAM-TDR-62-133, Dec. 1962. iii+7 p.

The ability of the hypothermic kidney to handle massive exogenous bicarbonate loads was studied in 5 dogs given 2.6% $NaHCO_3$ plus 0.75% creatinine and 0.1% para-aminohippuric acid intravenously at the rate of 4.0 ml./min. The renal hemodynamic pattern was typical of hypothermia with decreasing glomerular filtration rate (GFR), renal plasma flow, and blood pressure, along with increasing renal resistance. Urine pH rose to 7.95 while arterial pH, corrected to body temperature, reached a maximum of 7.56 and then slowly declined to 7.51 at 27°C. The acidosis of hypothermia is difficult to counteract. In spite of the fall in GFR. the urine flow, under the influence of the hyperosmotic load, increased progressively throughout the exposure. A depressing effect of cold on tubular transport of bicarbonate was seen. Although the bicarbonate load presented to the tubules remained near control levels, the reabsorption of bicarbonate fell from a normothermia value of 1.5 mEq./min. to 0.9 mEq./min. at 27°C. (Author's abstract)

354
Kanter, G. S.
REGULATION OF EXTRACELLULAR POTASSIUM IN HYPOTHERMIA.—Albany Medical Coll., Dept. of Physiology, New York (Contract AF 41(657)393); issued by School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775801). Technical Documentary Report no. SAM-TDR-63-14, June 1963. iii+10 p.

Hypothermia in anesthetized dogs lowered plasma potassium concentration from 3.91 mEq./liter to 3.07 mEq./liter at 29°C., in spite of the fall in arterial pH from 7.35 to 7.24. In normothermia, such a decrease in extracellular pH would cause an increase in plasma K concentration. Possibly, a K^+ for Na^+ exchange occurred in the renal tubule, with K^+ being excreted instead of H^+. As we expected that removal of renal function during hypothermia would allow the alteration in pH to cause an increase in extracellular K, dogs were studied after bilateral nephrectomy or bilateral ureteral tie; plasma K still fell markedly. Possibly intracellular pH decreased relatively more than did extracellular pH with a resultant movement of H^+ out of the cell and K^+ in. With renal function present, the influx of K into the cell seen in renally deficient dogs is reversed by the renal gradient which causes a decrease in both cellular and extracellular K. (Author's abstract)

355
Khvedelidze, G. V.
[THE EFFECT OF HYPOTHERMIA IN COMBINATION WITH HIBERNATION ON CONDITIONED REFLEXES ACTIVATED BY THE SOUND ANALYZER] Vliianie gipotermii v sochetanii s gibernatsiei na uslovnye refleksy, vyrabotannye so slukhovogo analizatora. —— Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 53 (6): 32-35. June 1962. In Russian, with English summary (p. 35).

Subjection of dogs to hypothermia (23-24° C. rectal temperature) induced by a combination of a lytic cocktail and cooling did not result in any disturbances of the temporary connection or differentiation of conditioned reflexes (unilateral conditioned reflexes to metronome beat established by electric stimulation applied to a tooth). Shifts in cortical activity after a single hypothermia exposure may possibly be detected with the establishment of more delicate differentiations or the formation of complex conditioned reflexes.

356
Kissen, A. T.
EFFECT OF HYPERTHERMIA ON PERIPHERAL DARK ADAPTATION RATES. —— Jour. Applied Physiol., 18 (3): 600-602. May 1963.

Peripheral dark adaptation curves were obtained on five subjects at comfort (21.0° C.) and 65.6° C. temperatures alternately, using a modified Hecht-Schlaer adaptometer. In 24 heat experiments, subjects were exposed to 65.6° C. ambient air temperature for 55 minutes after which the heat was shut off. Chamber temperature declined but the subjects remained in a relatively constant hyperthermic condition during the subsequent 35-minute dark-adaptation test. The criterion used here for hyperthermia was the elevation and maintenance of the rectal temperature at least 0.56° C. above corresponding control temperature. Curves obtained under hyperthermic conditions (with the exception of the initial and terminal values) differed, with statistical significance, from controls, indicating a facilitation of dark adaptation under the imposed thermal stress conditions. (From the author's abstract)

357
Korostovtseva, N. V.
[ON THE MECHANISM OF THE INCREASED RESISTANCE TO DEEP HYPOXIC HYPERCAPNIC HYPOTHERMIA IN RATS WITH PRELIMINARY TRAINING] O mekhanizme povysheniia ustoichivosti krys k glubokoi gipoksichesko-giperkapnicheskoi gipotermii pod vliianiem predvaritel'noi trenirovki. — Fiziologicheskii zhurnal SSSR (Moskva), 48 (10): 1209-1217. Oct. 1962. In Russian.

The combined training in hypoxia, hypercapnia, and hypothermia as a rule decreases the sensitivity of rats to oxygen deficiency. Increased tolerance of trained rats to hypoxia is not always accompanied by resistance to deep hypoxic-hypercapnic hypothermia, and hypothermia tolerance can increase without the increase of the hypoxia tolerance. The author believes that training of such nature induces a depression of the central nervous system and thus decreases the sensitivity to hypoxia.

358
Korostovtseva, N. V.
[CONDITIONING SCHEDULE AND SOME INDICATORS OF RATS' RESPONSE TO DEEP HYPOXIC-HYPERCAPNIC HYPOTHERMIA] O rezhime trenirovki i nekotorykh pokazateliakh trenirovannosti krys k glubokoi gipoksichesko-giperkapnicheskoi gipotermii.—Fiziologicheskii zhurnal SSSR (Moskva), 48 (12): 1466-1470. Dec. 1962. In Russian.

Rats were cooled repeatedly in a closed container maintained at 5° C. and their oxygen consumption was measured. After conditioning, the body temperature was lowered to 13-15° C. and cardiac activity and involuntary reflexes were measured. Conditioning of rats is very difficult due to considerable variability in the individual metabolism. The best results were obtained by employing a three-step conditioning process with a one-day interval between each step. Resistance to hypothermia in rats is paralleled by a corresponding intensification of the general metabolism and of the oxygen consumption. The changes in body temperature and oxygen consumption, in response to low temperatures, as well as the sensitivity to hypoxia could be regarded as indirect indicators of the ability to withstand the artificially induced deep hypothermia.

359
Lagerspetz, K.
TEMPERATURE ACCLIMATION AND EXPERIMENTAL TEMPORARY POIKILOTHERMIA IN MICE.— Annales medicinae experimentalis et biologiae Fenniae (Helsinki), 41 (2): 202-213. 1963.

The colonic cooling rate and the lowest achieved colonic temperature of mice following a subcutaneous injection of promazine at a given ambient temperature were found to be dependent on the acclimation temperature. The loss of thermoregulatory ability was greater in mice who received promazine than in those immobilized by fixing their limbs. As this difference persisted in a thermoneutral environment, it was considered to be partially a result of the decrease in minor motor activity caused by promazine. Promazine caused peripheral vasodilation and inhibited muscle shivering in mice acclimated to cold or warm environments. Cold acclimation in mice reduced the intensity of muscle shivering which normally occurs in response to cold. (Author's summary, modified)

360
Lesage, M. A.,
W. C. Sealy, and W. G. Young
DEEP HYPOTHERMIA IN THE RAT: STUDIES ON SURVIVAL AND TOLERANCE TO CIRCULATORY ARREST.—Duke Univ. Medical Center, Durham, N. C. (Contact AF 41(657)-312); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-03). Technical Documentary Report no. AAL-TDR-62-43, Feb. 1963. iii+12 p.

A study was carried out to establish whether or not rats could be regularly carried to deep hypothermia and then rewarmed without an excessively high mortality rate. A technique for inducing deep hypothermia is described. Rats were cooled to deep hypothermia and revived in a high enough percentage to permit quantitative estimates of other experimental situations. Hypoxia during cooling and warming is apparently important in the improvement of mortality figures. Circulatory arrest of 60 minutes or less is well tolerated during deep hypothermia. (Authors' abstract) (27 references)

361
Lind, A. R.
THE CONTROL OF DEEP BODY TEMPERATURE IN A WIDE RANGE OF CLIMATES. — Jour. Physiol. (London), 162 (1): 23P. June 1962.

A brief discussion of body temperature control in a wide range of climates is given. A large number of experiments on three subjects have shown that when the rates of work are 180, 300 or 420 kilocal./hr., the upper limits of the ranges of climates where deep body temperatures are dependent only or primarily on the rate of work are represented by effective temperature values of 30.2°, 27.3°, and 26.9° C., respectively. (Quoted in part)

362
Lindner, T.,
and G. Tunevall
HYPOTHERMIA AND INFECTION. III. INFLUENCE OF HYPOTHERMIA ON THE COURSE OF EXPERIMENTAL PNEUMOCOCCAL INFECTION IN MICE.— Scandinavian Jour. Clinical and Lab. Investigation (Oslo), 15 (2): 125-131. 1963. In English.

Experimental pneumococcal peritonitis was found not to result in bacteremia as regularly or as early in hypothermic mice as in normothermic controls. When once established, the bacteremia also increased in massivity more slowly in hypothermic mice, which also had a longer average survival time. Warming up of the hypothermic mice resulted in a rapidly increasing bacteremia and death, or in death not preceded by bacteremia. This might be due to a diminished resistance as a result of the previous hypothermia, to the trauma inherent in the rewarming procedure, or to an increased susceptibility to bacterial toxins during this process. (Authors' summary)

363
MacFarlane, W. V.
THERMAL BALANCE.—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 382-385. Amsterdam, Elsevier Publishing Company, 1963.

The thermal balance of an organism is considered in terms of heat transfer, radiant energy loss, and evaporation. A steady state with some oscillation compatible with health may be maintained at about an 80° C. range of environmental temperature. Comfort is achieved when the input and output of heat are almost equal. Thermal comfort, however, is determined subjectively depending upon acclimatization and genetic differences.

364
Maistrakh, E. B.,
I. V. Eremenko, G. I. Il'iutkin, and V. A. Konstantinov
[CYBERNETIC CONTROL OF THE PROCESS OF REVERSIBLE HYPOTHERMIA] Kiberneticheskoe regulirovanie protsessa obratimoi gipotermii.—Doklady Akademii nauk SSSR (Moskva), 151 (3): 714-717. July 21, 1963. In Russian.

The authors describe an automatic apparatus for the induction and monitoring of hypothermia, which controls the following physiological values: rectal temperature, skin temperature, respiratory volume, respiration rate, arterial pressure, and motor activity. A structural circuit chart is included. Experiments conducted on the anesthetized dogs showed the soundness of the proposed design.

365
Masoro, E. J.
ROLE OF LIPOGENESIS IN NONSHIVERING THERMOGENESIS.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 868-872; discussion, p. 872-873. May-June 1963.

A review is presented of in vitro experiments dealing with fatty acid synthesis from acetate-1-C^{14} in liver slices and in epididymal pads of cold-acclimated rats and hamsters. Results show an increase in lipogenesis in cold-acclimated rats which contributes to the increased heat production. In vivo corroboration of these results was carried out by administering glucose -C^{14} parenterally by stomach tube to rats fasted for three hours. Lipogenesis from dietary glucose appeared to occur at about the same rate in cold-acclimated and control rats, and thus was not part of the mechanism involved in increased heat production during the cold-acclimated state. This conclusion is not satisfactory because it does not explain the high lipogenic capacity of the cold-acclimated white adipose tissue so clearly established by in vitro experiments. It is possible that the cold-acclimated rat periodically reaches such high rates of caloric intake that the adipose tissue is called on to store large quantities of glucose carbon temporarily by converting it to fat. Included are various representative tables and graphs.

366
Matsko, S. N.
[THE CONDITIONAL NATURE OF ESTIMATES OF HYPOTHERMIA TOLERANCE OF ORGANISMS AND THEIR TISSUES] Uslovnosti v otsenke sposobnosti zhivykh organizmov i ikh tkanei perenosit' okhlazhdenie—Biulleten' Moskovskogo obshchestva ispytatelei prirody, Otdel biologicheskii (Moskva), 68 (3): 119-124. May-June 1963. In Russian.

The author presents his views, based on literature data, on criteria used in the estimates of viability after exposures of tissues and organisms to hypothermia. These criteria are: restitution after exposure of cellular motility, contractility of muscles tissue, and cellular reproduction. No original data are reported. (45 references)

367
Maur, J. M.,
D. M. McComiskey, J. W. Haynes, and J. R. Beaton
CARBOHYDRATE METABOLISM IN HYPOTHERMIC RATS AND HAMSTERS. — Canad. Jour. Biochem. and Physiol. (Ottawa), 40 (10): 1427-1438. Oct. 1962.

When fasted rats were cooled 15 minutes after the intraperitoneal administration of either glucose or sodium pyruvate, there was an impaired utilization of the glucose but not of the pyruvate. Rate of decrease of liver glycogen formed from administered glucose was not affected. The elevated level of blood lactic acid typical of hypothermic rats was further elevated by administration of pyruvate but not of glucose, suggesting increased production of lactic acid via pyruvic acid. Glucose utilization patterns of hamsters (hibernators) and rats (non-hibernators) were similar during hypothermia. In non-fasted hypothermic rats there was a progressive increase in blood glucose level accompanied by an initial decrease in liver glycogen level. Subsequent to this decrease in liver glycogen, there was a marked increase in the plasma level of ketone bodies. From the results of experiments with insulin- and alloxan-treated rats, it was concluded that metabolic alterations of hypothermia in rats may be modified in degree, but are not eliminated by a prior state of diabetes or by prior administration of insulin. (Authors' abstract, modified)

368
Milan, F. A.,
J. P. Hannon, and E. Evonuk
TEMPERATURE REGULATION OF ESKIMOS, INDIANS, AND CAUCASIANS IN A BATH CALORIMETER. — Jour. Applied Physiol., 18 (2): 378-382. March 1963.

Eighteen men: six Alaskan Eskimos, six Arctic Athapascan Indians, and six Caucasian U.S. soldiers were immersed serially in a bath calorimeter where the rates of heat production and loss were measured during whole-body exposure to water temperatures of 35, 33, and 30.5° C. At each of these temperatures the Eskimos exhibited the highest rates of heat production and loss, followed by the Indians and Caucasians in decreasing order. Duplicate basal metabolic rate measurements averaged 46 kilocalories/hour/m.^{2} in the Eskimos, 42.5 kcal./hr./m.^{2} in the Indians, and about 37 kcal./hr./m.^{2} in the Caucasians. Body fat percentages calculated by the skin-fold method were: Eskimos, 6.6%; Indians, 12.3%; and Caucasians, 15.6%. Calculations showed the Eskimos had the lowest tissue insulation followed, respectively, by the Indians and Caucasians. Calculations showed the lower insulation in the Eskimos was independent of their lack of body fat and probably reflected a greater peripheral blood flow. Since the rectal temperature decrements during immersion were the same in all three groups, it was concluded that the surface temperature gradients extended more deeply in the Eskimos than in the other two groups. (From the authors' abstract)

369
Mrosovsky, N.
RETENTION AND REVERSAL OF CONDITIONED AVOIDANCE FOLLOWING SEVERE HYPOTHERMIA.—Jour. Compar. and Physiological Psychol., 56 (5): 811-813. Oct. 1963.

Rats were cooled to 2°C. deep body temperature shortly after the acquisition of a conditioned avoidance response, cooling being initiated 15 minutes after the last criterion trial. The treatment did not significantly affect retention or unlearning of this task. (Author's summary)

370
Nelms, J. D.
FUNCTIONAL ANATOMY OF SKIN RELATED TO TEMPERATURE REGULATION.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 933-936. Mary-June 1963.

A brief review is presented of the skin structures known to be concerned in thermoregulation and acclimatization, with observations on the functional aspects of each. Included are: sensory innervators of the skin (Merkel's discs, Krause end bulbs, Meissner endings, Pacinian corpuscles, Ruffini endings, Palisades fibers); arteriovenous anastomoses; and sweat glands. An outline of the cutaneous blood vessels is also given.

371
Nešković, B.,
V. Vidović, and V. L. Vidović
THE EFFECT OF REPEATED DEEP HYPOTHERMIA ON THE CONTENT AND DISTRIBUTION OF ASCORBIC ACID IN THE ADRENAL CORTEX OF THE RAT.—Acta medica iugoslavica (Beograd), 16 (1): 41-49. 1962. In English.

Ascorbic acid was determined histochemically in the adrenal cortex of rats: at a body temperature of 30°C. when entering hypothermia; at a body temperature of 15°-18°C.; at 30°C. when rewarmed; immediately after restoration of normothermia; and at 20, 48, and 72 hours after return of normothermia. In normal, non-cooled rats the ascorbic acid content was distinctly distributed according to the tissue zones of the adrenal cortex. Individual variations were not significant. The largest amount was situated in the subcapsular zones, with smaller quantities in the intermedia and inner fasciculate zone. No significant difference in the content and distribution of ascorbic acid was found between animals who underwent hypothermia once, eight, or twenty times. Decrease of body temperature from 37.5°C. was followed by a constant and gradual decrease of adrenocortical ascorbic acid content. Ascorbic acid disappeared more rapidly from those zones which normally had the highest content; therefore, the zonal distribution of this substance disappeared during cooling. During rewarming from 16° to 37.5°C., gradual accumulation of ascorbic acid in the adrenal cortex was found and reappearance of zonal distribution. After normothermia was restored, accumulation of ascorbic acid in the cortex continued. Normal ascorbic acid content and distribution were attained 48 hours after restoration of normothermia. (Authors' conclusions, modified)

372
Ostashkov, K. V.
BLOOD SERUM PROTEINS UNDER CONDITIONS OF ARTIFICIAL HYPOTHERMIA,—Biochemistry (Consultants Bureau, New York), 26 (6): 836-838. May-June 1962.

English translation of: Belki syvorotki krovi v usloviiakh iskusstvennoi gipotermii.—Biokhimiia (Moskva), 26 (6): 966-969. Nov-Dec. 1961. In Russian, with English summary (p. 969).

The development of artificial hypothermia is accompanied by a progressive hypoproteinemia. The decrease was most pronounced for the globulin fraction, No severe shifts were noted in the ratios of basic protein fractions (albumins and globulins). Changes in the proportions of the blood proteins are evidenced by an increase in the α-globulin fraction and a decrease in the β and γ-globulins, both in the absolute and relative indices.

373
Panuska, J. A.,
and V. Popovic
LEARNING IN HYPOTHERMIC RATS.—Jour. Applied Physiol., 18 (5): 1016-1018. Sept. 1963.

Inexperienced shaved adult white rats cooled to a colonic temperature of 18.5°C. and then rewarmed to 26.0 C., were placed at an ambient temperature of 2.0°C. with the possibility of using a lever-activated heat reinforcement apparatus. Their body temperatures leveled at 29°C.; and during the next 40-80 minutes the rats either learned to press the lever systematically for external heat and thereby rewarmed themselves to euthermia, or they drifted into deeper hypothermia leading to death. Activity records and visual observations indicate that after an average of 48 minutes and at a body temperature of 29.6°C. (28.5-30.2°C.), out of a group of 14 rats 12 learned this technique necessary for their survival. All 12 rats reached euthermia and continued to use the lever as long as they remained in the experimental situation. It is concluded that learning is possible even at a low body temperature of 29.6°C. (Authors' abstract)

374
Popovic, P.,
and V. Popovic
SURVIVAL OF NEWBORN GROUND SQUIRRELS AFTER SUPERCOOLING OR FREEZING. — Amer. Jour. Physiol., 204 (5): 949-952. May 1963.

Six of seven 2-day-old ground squirrels survived without any harmful consequences 11 hours supercooling to body temperatures of -3° to -4° C. Longer exposure at the same body temperature was not followed by survival. Of 12 ground squirrels which were kept at stabilized body temperatures of -6° and -8° C. for 5 hours, 10 animals survived. Electrical activity of the heart was not detectable when the body temperature of ground squirrels was below -2° C. Immersion of newborn ground squirrels in -35° C. alcohol-dry-ice mixture caused their bodies to freeze after 15-20 seconds, suddenly turning white and rigid. Ground squirrels survived the freezing which lasted less than 2 minutes. At the end of 2 minutes immersion the esophageal temperature of cooled animals was -10° to -15° C. (Authors' abstract)

375
Prehatny, J. R.,
N. P. H. Ching, J. Y. Templeton, and T. F. Nealon
OXYGEN UPTAKE OF TISSUES FOLLOWING ACIDOSIS DURING PROFOUND HYPOTHERMIA. — Circulation, 27 (4, Part 2): 691-692. April 1963.

Oxygen consumption was measured in 12 dogs ventilated with 100% oxygen, when cooled until the esophageal and mixed venous blood temperatures were 15° C. Rendering the animals acidotic by the infusion of dilute hydrochloric acid did not change the consumption of oxygen. (Authors' summary, modified)

376
Randall, W. C.,
R. O. Rawson, R. D. McCook, and C. N. Peiss
CENTRAL AND PERIPHERAL FACTORS IN DYNAMIC THERMOREGULATION. — Jour. Applied Physiol., 18 (1): 61-64. Jan. 1963.

Direct measurements reveal that hypothalamic temperature is significantly higher than that of the tympanic membrane of the cat under Sernyl anesthesia. The posterior hypothalamus is warmer than the anterior hypothalamus. Bilateral carotid occlusion results in prompt elevation in both anterior and posterior hypothalamic temperatures while the tympanic membrane simultaneously cools. Thus, the hypothalamus is normally cooled by its arterial blood supply while the tympanic membrane is warmed by it. The marked differences in relative temperatures, together with opposite temperature changes imposed by arterial occlusion, underline the danger of assuming identity in temperature of these areas under dynamic conditions. The elicitation of sweating in man by a strong heat stimulus applied to occluded extremities strongly supports the hypothesis that cutaneous thermal receptors participate. The merging of a hot sensation into one of severe pain strongly suggests the participation of the C-fiber system of cutaneous afferents in the response. It is concluded that sweating may be elicited by (1) a primary stimulus arising within the thermal receptors of the anterior hypothalamus, (2) stimulation of cutaneous thermal receptors, or (3) some combination of the two. (Authors' abstract)

377
Rennie, D. W.,
B. G. Covino, M. R. Blair, and K. Rodahl
PHYSICAL REGULATION OF TEMPERATURE IN ESKIMOS. — Jour. Applied Physiol., 17 (2): 326-332. March 1962.

Temperature regulation of Eskimos and non-Eskimos, exclusive of shivering, was compared over a range of controlled conditions that produced near-maximal sweating (room temp., 35° C.) to maximal cutaneous vasoconstriction (23° C. air or 33° C. water bath). The Eskimos consistently produced 15-20 kcal./m.^{2}/hour more heat at rest. This may or may not be cold adaptation. In air warmer than 28° C. their surfeit of heat resulted in higher tissue conductances, warmer skin, and greater sweating. In cooler air and 33° C. water, the physical conductance of heat through tissues of the Eskimos remained 60% greater and resulted in warmer skin or a greater fall of rectal temperature. This can be accounted for on physical grounds, since the Eskimos had 1 cm. less subcutaneous fat than did non-Eskimos. The value of high metabolism and high tissue conductance to fully clothed Eskimos would appear to be reflex vascular convection of heat to distal extremities, since average skin temperatures under their clothing are comparable to those of unclothed Eskimos in room temperatures exceeding 28° C. (Authors' abstract)

378
Rennie, D. W.
COMPARISON OF NONACCLIMATIZED AMERICANS AND ALASKAN ESKIMOS.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 828-830. May-June 1963.

No difference was found in thermoregulation between Eskimos and nonacclimatized American males sitting unclothed for three hours at temperatures ranging from 23° C. to 35° C. Both presented a similar cutaneous sensory threshold for shivering or sweating at extremes of environmental temperature. Over-all tissue insulation during maximal vasoconstriction, though significantly less in Eskimos was what could be predicted for nonacclimatized American males of comparable fat thickness. The Eskimo had a higher metabolic rate (30-40% higher) which allowed him to cool for a longer time before shivering supervened, or conversely, forced him to perspire more at air temperatures considered comfortable. Greater nonshivering metabolism, combined with excellent clothing, may adapt the Eskimo better to an environment of extreme cold, for the need to lose heat rather than conserve it predominates during their daily activities. Under these conditions, circulation to distal extremities provides protection against loss of function and cold injury. Included are graphic and tabulated measurements of mean metabolic rate, sweat heat loss, tissue conductance, maximal tissue insulation, and mean resting metabolism of Eskimos and non-Eskimos.

379
Russ, C.,
and J. C. Lee
CHANGES IN EFFICIENCY AND METABOLISM OF THE MYOCARDIUM IN DOGS EXPOSED TO 25° C FOR 24 HOURS [Abstract]. — Physiologist, 5 (3): 207. Aug. 1962.

In a previous investigation we observed a decline in cardiac output in dogs as hypothermia (20°-25° C.) was prolonged. The decline in cardiac output was accompanied by an increasing arteriovenous oxygen difference which appeared to be associated with an increase in plasma transaminase activity. Almost all dogs dying during the late hours (18-24) of cooling did so after cardiac output had decreased markedly. On the basis of these observations, our attention in this report is directed to changes in myocardial efficiency and metabolism in dogs exposed to prolonged cooling. (Authors' abstract)

380
Seki, K.,
F. Flath, and A. B. Hertzman
SKIN PULSES AND HEAT TRANSFER.—St. Louis School of Medicine, Mo. (Contract AF 33(616)-7077); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722204). Technical Documentary Report no. MRL-TDR-62-43, May 1962. iii+19 p.

Calorimetric estimates of cutaneous blood flow in the finger pads, calf, and forearm were compared with simultaneous photometric recordings of the skin pulses by photoelectric plethysmographs in these same areas. The amplitude of the skin pulse, expressed as per cent decrement in photoelectric current, was related linearly to the blood flow, during cutaneous vasodilatation elicited by body heating and by the local application of a vasodilator drug. Cutaneous blood flow in any skin region of the normal resting subject may be estimated from the relation, blood flow in cm.^{3}/cm.^{2}/min. = 0.2 A, where A is the amplitude of the skin pulse expressed as per cent decrement in photoelectric current. (Authors' abstract)

381
Serafimov, N.
THYROID FUNCTION IN HYPOTHERMIA, HYPERTHERMIA AND FEVER. [Abstract].—Conseil des Academies de la R.P.F. de Youguslavie, Bulletin scientifique, (Zagreb), 7 (6): 173-174. Dec. 1962. In English.

The thyroid function was studied in hypothermia, hyperthermia, and fever in rats and dogs using the following methods: thyroid I^{131} and I^{132} uptake by surface and in vitro counting, thyroid plasma I^{131} clearance, plasma protein-bound iodine (PBI^{131}) and conversion rate, acid butanol extraction of PBI^{131}, biological half-life of thyroid radioactive iodine, and release of thyroid hormones by thyroid vein blood samples. Hypothermia was induced by Gjaja's method of hypoxic hypercapnia in rats, immersion and ice surface cooling, and blood stream cooling in dogs. Hyperthermia was induced by immersion or blood stream heating, and fever by endotoxin injection. Hypothermia always brought about a reduction in all indices of the thyroid iodine uptake. The biological half-life of radioiodine was shortened in light hypothermia and prolonged in deep hypothermia. During light hypothermia there was a reduction of I^{131} uptake while at the same time the thyroid hormone secretion increased as shown in thyroid vein blood samples. Hyperthermia by overheating and endotoxin-induced fever in dogs and rats also reduced the thyroid I^{131} uptake, but without demonstrable changes in thyroid vein PBI^{131}. The mechanism of the hypothermic changes in thyroid function is considered in terms of the principle of biphasic changes in all physiological processes during different degrees of hypothermia where it appears to apply only to the hormone release but not to the thyroid uptake of iodine.

382
Severin, S. E.
[THE ROLE OF ANAEROBIC AND OXIDATIVE PHOSPHORYLATION IN REGARD TO THE PROTECTIVE FUNCTION OF THE ORGANISM] Rol' protsessov anaerobnogo i okislitel'nogo fosforilirovaniia v zashchitnykh funktsiiakh organisma.—Vestnik Akademii meditsinskikh nauk SSSR (Moskva), 1962 (5): 93-101. 1962. In Russian.

The author discusses the role played by adenosinetriphosphoric acid (ATP) in regard to the protective functions of the organism. ATP metabolism follows two general pathways—glycolysis or oxidative phosphorylation—which are discussed in some detail. In the case of hypothermia, oxidative phosphorylation plays a significant part in the adaptation reaction. Mice and pigeons exposed to hypothermic conditions are able to adapt to them due to a shift from oxidative phosphorylation to free oxidation. In the muscle cell mitochondria of test animals, the phosphorus/oxygen (P/O) ratio dropped from 1.04 to 0.22 after adaptation, while in the cardiac muscle the corresponding drop in P/O was from 1 to 0.65. Upon addition of Ca ions, the drop was even more pronounced (from 0.39 to 0), while the introduction of serum albumin resulted in complete restitution of the original P/O ratio. Since it is possible to restore the P/O ratio to normal values, it is concluded that the disturbances in P/O ratio caused by hypothermia can be regarded as normal protective adaptation reactions.

383
Shek, M. P.
[HYPERTHERMIA IN DOGS AND ITS DEPENDENCE ON BODY WATER RESOURCES DURING MUSCULAR EXERTION AT HIGH ENVIRONMENTAL TEMPERATURE] Gipertermiia u sobak i ee zavisimost' ot vodnykh resursov organizma pri myshechnoi rabote v usloviiakh vysokoi temperatury sredy.—Fiziologicheskii zhurnal SSSR (Moskva), 49 (5): 542-547. May 1963. In Russian.

Three dogs were exposed to an environmental temperature of 45° C. with relative humidity of 19-23%, or to either 30-37° C. or normal temperature while running in a treadmill. The water intake was regulated, i.e., the animals were exposed to conditions ranging from drinking ad libitum to sham drinking. The onset of hyperthermia was delayed when water was available at high environmental temperatures; however, water intake had no effect on hyperthermia due to muscular exertion.

384
Simpson, M. A.
HYPOTHERMIA AND RAPID REWARMING: REPORT OF A CASE.—Alaska Med., 7 (1): 7-8. March 1962.

A child suffering severe exposure to cold had an apparently complete recovery after submersion in a warm bath for ninety minutes. Oxygen was used for a short time. No sedatives, antibiotics, or other forms of treatment were given. (Author's summary)

385
Sonim, A. D.
[HEAT REGULATION AND VOLUNTARY MUSCULAR ACTIVITY IN ANIMALS] Termoregulacja i dowolna aktywność ruchowa zwierząt—Wychowanie fizyczne i sport (Warszawa), 7 (1): 3-10. 1963. In Polish, with English summary (p. 10).

The author discusses the interrelation between voluntary muscular activity of animals, their body temperature, and ambient temperature. Body temperature and its rise are considered to be factors which restrict muscular activity and cause fatigue. The duration and the intensity of voluntary forms of animal muscular activity (play) as well as involuntary (forced) forms of muscular activity decrease with the rise in ambient temperature. A hypothesis is proposed on the presence of a thermostatical mechanism which restricts voluntary muscular activity in animals. This mechanism is based on heat regulation and heat reception processes. (From the author's summary)

386
Starkov, P. M.,
and E. K. Aganiants
[RESTITUTION OF THE ELECTROENCEPHALOGRAM AFTER HYPOTHERMIA] Vosstanovlenie elektroentsefalogrammy posle gipotermii.—Fiziologicheskii zhurnal SSSR (Moskva), 48 (6): 629-637. 1962. In Russian.

Seven cats and 12 rabbits were chilled to 17°-20° C. and 15°-18° C., respectively. Deep hypothermia caused a sharp decline of electroencephalographic activity, which, however, persisted as long as there was independent respiration. The restitution of the EEG began in cats at a body temperature of 23° C., in rabbits at 25° C. In the process of EEG restitution the α and β rhythms developed ahead of the full recovery of the α wave potentials. (24 references)

387
Szegvári, G.,
and I. Várnai
THE EFFECT OF HYPERCAPNIA ON HEAT PRODUCTION AND COLONIC, MUSCLE, AND SUBCUTANEOUS TEMPERATURES IN THE RAT: THE SITE OF THERMOREGULATORY HEAT PRODUCTION. —— Acta physiologica Academiae scientiarum hungaricae (Budapest), 21 (1): 65-72. 1962. In English.

Exposure of anesthetized rats at 20° C. to 2% carbon dioxide failed to elicit consistent responses. Exposures to 4-6 and 12% carbon dioxide were followed by a marked and immediate decrease in heat production and in colonic temperature. Muscle and subcutaneous temperatures increased slightly but significantly during the first minutes and declined below the initial level after the fifth minute. After resumption of air breathing, heat production and colonic temperature rose immediately whereas muscle and subcutaneous temperatures continued to fall for about five minutes. The results indicate the primary role of the internal organs and not of the striated muscles in thermoregulatory heat production in the rat within certain limits of environmental and body temperatures. (Authors' abstract, modified)

388
Szegvári, G.
LOCALIZATION OF THERMOREGULATORY HEAT PRODUCTION [Abstract].—Acta physiologica Academiae scientiarum hungaricae (Budapest), 22 (suppl.): 20. 1963. In English.

In adult rats under light urethane anesthesia continual recordings were made of the oxygen consumption, colonic, muscle, and subcutaneous temperatures, electric activity of the lumbar and thigh muscles, on transfer from indifferent to cool temperature, at cool ambient temperature (19° to 21°C.), as well as in the same environment during hypoxia (12% oxygen) and hypercapnia (6% carbon dioxide). The results indicate that (a) there is no close correlation between the changes in electric muscular activity and the changes in heat production; (b) the musculature is not the primary site of non-shivering heat production; and (c) a global control of heat production should be taken into account. (Author's abstract)

389
Szegvári, G.,
I. Várnai, and S. Donhoffer
THE EFFECT OF ENVIRONMENTAL TEMPERATURE, HYPOXIA, AND HYPERCAPNIA ON TOTAL HEAT PRODUCTION AND THE ELECTRICAL ACTIVITY OF MUSCLES IN THE RAT: SHIVERING AND NON-SHIVERING THERMOGENESIS AND THE SITE OF NON-SHIVERING HEAT PRODUCTION.—Acta physiologica Academiae scientiarum hungaricae (Budapest), 23 (1): 49-62. 1963. In English.

Continuous measurements were made of the electrical activity of the back and thigh muscles, of oxygen consumption, and of colonic and muscle temperatures in rats during exposure to cool ambient temperatures (19°-23° C.), and at similar temperatures to hypoxia (breathing of 12% oxygen), and hypercapnia (breathing of 6% carbon dioxide). Non-shivering thermogenesis was found in the rat not adapted to cold with an increase in total heat production and electrical activity; whereas, in the cold adapted animal, the rise in oxygen consumption preceded the increase in electrical activity. Hypoxia initiated a decrease in electrical activity with a concomitant decline in oxygen consumption and body temperature. At the termination of hypoxia oxygen consumption increased immediately and approached the maximum before the onset of intense electrical activity. The subsequent gradual rise in oxygen consumption recorded during hypercapnia was not accompanied by any change in muscle electrical activity. Changes in colonic and muscle temperatures associated with changes in thermoregulatory heat production during exposure to cold, hypoxia, and hypercapnia indicate that non-shivering thermoregulatory heat production is not of skeletomuscular origin. (50 references)

390
Teramoto, S.,
and H. B. Shumacker
HEPATIC BLOOD FLOW IN THE MODERATELY HYPOTHERMIC STATE. —— Jour. Surgical Research, 2 (1): 3-6. Jan. 1962.

The circulation in ten dogs with the body temperature lowered to 27.5 to 30° C. was compared to that of ten normothermic animals. Mean hepatic blood flow in the hypothermic animals was 27.5 cc./kg./min. and remained relatively stable throughout the experiment. In the normothermic dogs the mean hepatic blood flow tended to drop during the experiment, going from 40.9 to 34.2 cc./kg./min. at the completion of the study. The total hepatic blood flow was about 31% of the cardiac output in the normothermic and 45% in the hypothermic dogs. It appears that with moderate hypothermia the total hepatic flow decreases proportionately less than do cardiac output and hepatic arterial flow.

391
Terzioglu, M.,
F. Emiroglu, and N. Gökhan
RESPIRATORY REGULATION IN HYPOTHERMIA [Abstract].—International Congress of Physiological Sciences, 22 (Leiden, 1962). Proceedings, vol. 2, no. 704. Amsterdam [1962?].

The sensitivity of respiratory center during progressive hypothermia was tested in normal, lightly anesthetized and surface-cooled dogs by the breathing of 10% oxygen in nitrogen. Respiratory responses in hypothermia, down to a temperature level of 25.5° C. were comparable to those observed under normothermic conditions. That an effective regulation of blood reaction also occurred was deduced from the data on acid-base balance. Below 25.5° C. hypoxic stimulus was ineffective. In a second series on chemoreceptorless dogs, similarly treated, a depression of respiration was always noted in hypothermia and hypoxia. Under normothermic conditions, however, the same animals responded to hypoxia by a slight stimulation of respiration. These findings together with the responses of normal dogs to hypoxia in hypothermia suggested that the diminution of respiration on cooling may be brought about by a depressed excitability of the center rather than of the chemoreceptor zones. In order to test this point, potentials were recorded from the sinus nerve of dogs, subjected to hypoxia, at various stages of hypothermia. The results clearly indicated that chemoreceptors retain their sensitivity to hypoxia down to very low temperature levels. Therefore, the cause of the diminution of respiration in hypothermia should be sought in a failure of central rather than of peripheral mechanisms concerned. (Authors' abstract)

392
Tunevall, G.,
and T. Lindner
HYPOTHERMIA AND INFECTION. II. ENDOGENEOUS PERITONITIS AND BACTEREMIA IN HYPOTHERMIC MICE.—Scandinavian Jour. Clinical and Lab. Investigation (Oslo), 15 (2): 115-124. 1963.

In experiments with mice, hypothermia at 22°-23° C., when maintained more than 40 hours, almost invariably resulted in the emergence of bacteria in peritoneal fluid and blood. These bacteria belonged to species present in the intestine. Elimination from the blood stream of injected bacteria was found to be disturbed in hypothermic animals, and more so the longer the previous period of hypothermia. *Klebsiella*, rapidly eliminated in normal mice, diminished in number only during a period of two to four hours, but thereafter increased again and caused a profuse bacteremia in hypothermic mice. Treatment with a sulfa-streptomycin combination provoked a shift of the intestinal flora towards a dominance of enterococci and diminished considerably the incidence of bacteria in peritoneal fluid and in blood, but did not influence the survival time of hypothermic mice. Deep and prolonged hypothermia in mice results in an invasion of bacteria from the intestine into the peritoneal cavity or into the blood stream or both. This invasion is not due to any change in the intestinal flora but may be contributed to by an inability of hypothermic mice to eliminate bacteria from the blood stream. (Authors' summary and conclusions, modified)

393
Ulmer, F.,
W. Koenig, E. Binder, and H. Hendriok
[CIRCULATION IN HYPERTHERMIA] Kreislauf in Hyperthermie. —— Pflügers Archiv für die gesamte Physiologie (Berlin), 276 (1): 66-81. 1962. In German.

Continuous measurement of the peripheral resistance, heart-minute volume, stroke volume, arterial pressure, heart rate, and oxygen consumption was undertaken in 33 anesthetized dogs during warming from 38° to 43.5° C. rectal temperature at ambient air temperatures ranging between 39 and 42° C. In the first stage of hyperthermia, the cardiovascular system reacts by a lowering of the peripheral vascular resistance and arterial pressure; the heart minute volume, stroke volume, and heart rates increase at 41-42° C.; oxygen consumption rises steadily as the temperature rises from 38 to 42° C. Second-stage hyperthermia is characterized by increasing circulatory insufficiency with a fall in peripheral vascular resistance, heart minute and stroke volumes, and arterial pressure in the presence of a rapidly rising heart rate. Above 43° C., oxygen consumption drops to normothermic values; the carotid sinus reflex remains unaffected. The intervals of the electrocardiogram–shorter than expected in relation to the rise in the heart rate–indicate a direct effect of the temperature on the depolarization and repolarization processes in the heart. (29 references)

394
Usinger, W.
[SURVIVAL TIME AND MAXIMAL LIFE SPAN IN DEEP HYPOTHERMIA] Überlebenszeit und maximale Lebensdauer in tiefer Hypothermie. —— Pflügers Archiv für die gesamte Physiologie (Berlin), 275 (6): 646-657. 1962. In German.

The median survival time and the average maximal life span were determined in 270 male albino mice in deep hypothermia with preserved spontaneous respiration. Median survival time and maximum life span decline exponentially with declining body temperature (m.s.t. = 13 hours at 14° C., 2.8 hours at 6° C.; m.l.s. = 17.5 hours at 15° C., 4 hours at 5° C.). Shorter survival times reported by other researchers are probably due to different cooling methods. Heart and respiratory rates fall exponentially due to the effect of cold. At reduced constant body temperature, heart rate and respiratory rate fall steadily as a function of the duration of hypothermia. Rewarming is successful only when both parameters have not fallen below critical values determined by the body temperature. Hypothermia is not a steady state in the homeothermic animal. Even at a constant reduced body temperature there are various changes taking place which unavoidably lead to death from the effects of cold. (Author's summary, modified)

395
Veksler, IA. I.,
and Z. S. Gershenovich
[THE AMMONIA–GLUTAMIC ACID–GLUTAMINE SYSTEM IN THE RAT BRAIN IN VARIOUS PHASES OF HYPOTHERMIA] Systema ammyak–gliutaminovaia kyslota–gliutamyn mozga krys pry raznykh fazakh hypotermyy. —— Ukrains'kyi biokhimichnyi zhurnal (Kyiv), 34 (3): 406-416. 1962. In Ukrainian, with English summary (p. 416).

Experiments on 219 albino rats showed that hypothermia leads to a distinct disturbance in the ammonia metabolism of the brain with rapid accumulation of free ammonia in the brain tissue. Restoration of the ratios in the ammonia–glutamic acid–glutamine system during rewarming after cooling is slow and in some cases does not reach the normal within six weeks after rewarming. Active warming in comparison with spontaneous rewarming does not perceptibly affect the metabolism restoration process in the brain. (From the authors' summary)

396
Złotnicki, B.
[INVESTIGATIONS OF ADAPTABILITY TO LOW TEMPERATURES AS A METHOD FOR THE DETERMINATION OF THE PHYSIOLOGICAL AGE] Badania przystosowania do niskich temperatur jako metoda oznaczania wieku fizjologicznego. —— Acta physiologica polonica (Warszawa), 13 (6): 789-795. 1962. In Polish, with English summary (p. 794).

The hypothesis that impaired adaptability to changes in environmental conditions is the most significant symptom of aging was applied experimentally in search for a method of determination of the physiological age of animals. To estimate adaptability, the author investigated the body temperature of 20 albino rats aged 6 and 18 months, which were exposed to a temperature of -10° C. for 1/2, 1, 2, 3, and 4 hours. In old rats, the body temperature fell lower and was restored to the normal level more slowly than in young animals. The experiments have shown that for albino rats 2-hour cooling at -10° C. may serve as a standard test for estimating their adaptability and consequently their physiological age. (Author's summary, modified)

f. Alimentary and Excretory Physiology

[*Flight feeding under 11-g*]

397
Karvinen, E.,
M. Miettinen, and M. J. Karvonen
FAT-MOBILIZING ACTIVITY OF HUMAN FASTING URINE. —— Annales medicinae experimentalis et biologiae Fenniae (Helsinki), 40 (3): 263-267. 1962.

Twelve healthy men fasted for two days. Fat-mobilizing activity of their urine extracts collected during that period was determined by injecting 1, 5, or 10% of the factor excreted per person per day subcutaneously in mice. The highest dose of urine extract of the first fasting day was found to increase significantly the amount of liver fat. On the other hand, the urine extract of the second fasting day seemed to alter the liver but the changes were not statistically significant. The second day fasting urine extract had no significant effect on fatty acid or sterol biosynthesis from acetate-1-C^{14} in vivo. The results indicate that significant amounts of the fat-mobilizing activity were excreted during the first fasting day but there was less excretion of the activity during the second fasting day. (Authors' summary, modified)

398
Komives, G. K.,
S. Robinson, F. R. Meyer, C. H. Ts'ao, and J. T. Roberts
UREA TRANSFER ACROSS THE SWEAT GLANDS. [Abstract]. —— Physiologist, 5 (3): 169. Aug. 1962.

The effects of varying the plasma urea level and the rate of sweating on the concentration of urea in the sweat were studied on men walking on a motor-driven treadmill in a hot, dry environment in which sweat evaporated from the men as it was formed. When plasma urea was raised 4-fold (150 mg.%) by the ingestion of urea, the urea level of the sweat always remained the same as that of the plasma. The sweat and plasma concentrations also remained the same despite an almost 2-fold variation in the sweat rate. This relation was unaffected during adaptation of the men to salt deficiency in which the sweat glands were forced to increase their osmotic work. These results were interpreted to mean that sweat urea arises from the extracellular fluid by a process of passive diffusion across the sweat glands. Since the urea level in the plasma and sweat were the same, it was concluded that when the skin is functioning under normal atmospheric conditions the amount of urea cleared by the sweat glands depends entirely upon the sweat rate. In one series of experiments, the kidney urea clearance was 45 ml./1.73 m.^{2}/min. while that of the sweat glands was 17 ml./1.73 m.^{2}/min. at a sweat rate of 15 ml./1.73 m.^{2}/min. (From the authors' abstract)

399
Mahan, C. S.,
W. S. Lovrinic, Wendell E. Jones, D. P. Goldstein, E. L. Beckman, and R. E. DeForest
EFFECT OF GRADIENT PRESSURE UPON PHYSIOLOGICAL SYSTEMS. —— Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask no. MR005.13-4001.06, Report no. 1). Report no. NADC-MA-6218, Dec. 28, 1962. ii+28 p.

Dehydration is one of the serious problems resulting from prolonged water immersion. A series of experiments was carried out involving four subjects immersed in water up to neck level for periods of four, six, and nine hours at a temperature of 75°, 85°, and 95° F., respectively. During partial body immersion at water temperatures of 85° and 75° F., with fluid replacement, diuresis was the same for both temperatures. When the fluid loss was not replaced, the magnitudes of diuresis were approximately equal and were about double the urinary output resulting from immersion in water at 95° F. This was attributed to the active vasoconstriction in the cold water. Changes in urinary pH and specific gravity, and in heart rate and core body temperature were also determined. The currently held concept, that survival from disaster at sea when immersed in water at temperatures above 70° F. is not limited by heat loss, becomes suspect in the light of the results. (From the authors' summary) (20 references)

400
Naitove, A.,
and S. M. Tenney
EFFECTS OF HYPOXIA AND HYPERCAPNIA ON GASTRIC ACID SECRETION IN MAN. —— Gastroenterology, 43 (2): 181-188. Aug. 1962.

The separate and interacting effects of alveolar carbon dioxide and oxygen tensions on gastric acid secretion were studied in normal humans exposed to a variety of gas mixtures at sea level and at high altitude (14,246 feet). Post-test meal acid secretion was, in general, directly related to alveolar carbon dioxide tension. Moreover, the amount of acid secreted at any given carbon dioxide tension was found to increase as the accompanying oxygen tension decreased. However, elevation of carbon dioxide tension was shown not to affect fasting secretion in man. It is concluded that changes in carbon dioxide and oxygen tensions can significantly modify an existing state of acid secretion, but that this cannot be universally demonstrated in all types of secretory studies. The possible role played by changes in gastric blood flow in determining the gastric secretory responses is discussed. (Authors' summary)

401
Vaughan, D. A.,
and R. L. Winders
ARCTIC SURVIVAL RATIONS. X. DIURNAL VARIATIONS OF SOME LIVER CONSTITUENTS IN RATS FED PEMMICAN MEALS.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-03). Technical Documentary Report no. AAL-TDR-62-54, March 1963. iii+8 p.

Diurnal variations in liver glycogen content and the activities of certain liver enzymes following 2-hour feeding periods were studied in trained-fed rats adapted to high-carbohydrate or carbohydrate-free diets. The results indicated that time after feeding a high-carbohydrate meal affected the activities of glucose-6-phosphatase and glutamic-pyruvic transaminase, but not glucose-6-phosphate dehydrogenase. These time-related changes were modified by meal-feeding the carbohydrate-free diet. Glycogen deposition following a carbohydrate-free meal indicated a rapid takeover of gluconeogenesis. (Authors' abstract)

g. Endocrinology

402
Cross, B. A.,
and L. A. Silver
CENTRAL ACTIVATION OF THE SYMPATHETICO-ADRENAL SYSTEM BY HYPOXIA AND HYPERCAPNIA. —— Jour. Endocrinol. (London), 24 (1): 91-103. March 1962.

Sympathetico-adrenal vasoconstrictor activity was monitored in rabbits under urethane anesthesia. Electrical stimulation of the dorsal, lateral and posterior hypothalamus evoked a sympathetic response characterized by a rapid nervous effect and secondary humoral effect which outlasted the stimulus, resembled the response to intravenous adrenaline, and was abolished by removal of both adrenal glands. Hypoxia produced by making the animals inhale nitrous oxide or nitrogen for 15-30 seconds and hypercapnia induced by inhalation of a mixture of 80% carbon dioxide and 20% oxygen for 5-15 seconds both induced a sympathetic discharge similar to that resulting from hypothalamic stimulation. Hypercapnia was a notably more potent stimulus than hypoxia. It is concluded from the results that the hypothalamus may participate in the sympathetico-adrenal discharge initiated by hypoxia and hypercapnia. (Authors' summary, modified)

403
Remmele, W.
[HORMONIC REGULATION OF ERYTHROPOIESIS]
Die humorale Steuerung der Erythropoiese—
xi+274 p. Berlin: Springer Verlag, 1963. In German.

The humoral regulation of erythropoiesis is effected (a) through a specific hormone "erythropoietin" and (b) through nonspecific regulation by hormones released by endocrine glands. Analysis of the clinical and experimental data points to the kidney as the site of formation of erythropoietin; in addition, other organs, i.e., the liver, may be involved. The reticuloendothelial system is less likely to participate in the erythropoietin formation. Erythropoiesis is apparently regulated by stimulation by the erythropoietin and by inhibition through erythropenin supposedly formed in blood serum saturated with oxygen. The nonspecific regulation of erythropoiesis is chiefly due to the gonadal hormones, whereby testosterone stimulates the bone marrow, while estradiol inhibits it; and to certain anterior-pituitary hormones with direct (STH) and indirect action (ACTH, TSH) on the erythropoiesis. The equilibrium between the destruction and the formation of erythrocytes is maintained by the specific and nonspecific regulatory processes which interact and supplement each other. (1101 references)

404
Tiisala, R.
ENDOCRINE RESPONSE TO HYPEROXIA AND HYPOXIA IN THE ADULT AND NEWBORN RAT: AN EXPERIMENTAL STUDY WITH RADIOACTIVE PHOSPHORUS. —— Suomalaisen tiedeakatemian toimituksia (Annales Academiae scientiarum fennicae) (Helsinki), Series A, V (Medica), no. 95. 141 p., 4 plates. 1962. In English.

The effect of hyperoxia (95% O_2, 48 hr.) on adult, growing, and newborn rats was studied by parallel observations in a number of organs. Observations were also made of the effect of two types of hypoxia (Hypoxia I = 5% O_2, 12 hr.; and Hypoxia II = 10% O_2, 48 hr.) on adult and newborn rats. Data are given on the changes observed in endocrine glands (adrenals, thyroid, testes, and hypophysis) and other organs (thymus, spleen and lungs). In adult rats in both the hyperoxia and hypoxia the endocrine response corresponded, on the whole, to that seen in acute non-specific stress. Stress factors probably have a specific effect on the thyroid. Newborn rats did not reveal similar features. Thus the endocrine response of the newborn and adult rats differed at least in quantity. The time for the change in the manner of reaction to hyperoxia is between the age of 10 days and 3 weeks. The absence of an endocrine response in the newborn, or at least its quantitative difference from that in adults, is probably due to the absence of endogenous ACTH stimulation, or to the presence of only a weak one. (From the author's summary) (182 references)

h. Other Systems

405
Edwards, W. E.
THE STUDY OF MONKEY, APE AND HUMAN MORPHOLOGY AND PHYSIOLOGY RELATING TO STRENGTH AND ENDURANCE. I. THE RELATIONSHIPS OF HUMAN SIZE TO STRENGTH.—Univ. of Chicago, Ill. (Contract AF 29(600)-3466); issued by Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6892, Task no. 689201). Technical Documentary Report no. ARL-TDR-63-19, July 1963. v+23 p.

Actual relationships of human size to strength have remained undetermined despite decades of research by many investigators because the determination necessitates valid theoretical formulation and selection through three essential criteria of a proper sample of subjects for empirical testing. The formula is:

$$\text{strength} = k \cdot \frac{\text{volume (weight)}}{\text{height}}.$$

Champion weightlifters satisfy all criteria, and, by minor adjustments for sample size and skeletal proportion, specific lifts can be predicted within ounces. (Author's abstract) (44 references)

406
Eisler, H.
SUBJECTIVE SCALE OF FORCE FOR A LARGE MUSCLE GROUP. —— Jour. Exper. Psychol., 64 (3): 253-257. Sept. 1962.

The subjective force of pushing a pedal with the leg has been scaled as an instance of the subjective force exerted by a large muscle group. The following methods were employed: magnitude estimation, magnitude production, matching the force of handgrip to the force of foot pressure and vise versa, and matching both foot pressure and handgrip to the intensity of white noise. The experiments involving numbers yielded a power function with an exponent of 1.6 relating subjective force to physical force. All the matching experiments showed that the exponent for force of foot pressure and force of handgrip is the same. The exponent for handgrip has previously been determined as 1.7. Thus the subjective force of foot pressure, as measured in this study, approximates a power function of physical force not appreciably different from the one found earlier for force of handgrip. The exponent for foot pressure approximates 1.65. (Author's summary)

407
Hertzman, A. B.
and F. Flath
CONTINUOUS SIMULTANEOUS REGISTRATION OF SWEATING AND BLOOD FLOW IN A SMALL SKIN AREA.—St. Louis Univ. School of Medicine, Mo. (Contract AF 33(616)-7077); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722204). Technical Documentary Report no. AMRL-TDR-63-16, Feb. 1963. iii+9 p.

A capsular method is presented for recording evaporation from a small skin area (5, 10, or more $cm.^2$), continuously, quantitatively and with a very fast response time as brief as 0.15 seconds. Water of diffusion at rates of 0.005 $mg./cm.^2/min.$ or high sweating rates were measured with equal ease. The method is combined with photoelectric recording of the skin pulses to provide precise temporal relations of cutaneous vascular events and of sweating in the same segment of skin. Cycles of sweating in forearm occurred synchronously with digital vasoconstrictions but were not accompanied by changes in the rate of blood flow in the forearm skin although venoconstriction in the forearm often took place with an increase in sweating. The observation contradicted the concept of bradykinin as an important vasodilator in accounting for cutaneous vasodilatation during heat stress. (Authors' abstract)

408
Matveev, Dr.,
and El. Kiselkova
[ELECTROMYOGRAPHIC AND ELECTROENCEPHALOGRAPHIC CHARACTERISTICS OF MUSCLE WORK AND MUSCLE FATIGUE] Elektromiograficheskaia i elektroentsefalograficheskaia kharakteristika myshechnoi raboty i myshechnogo utomleniia.—Fiziologicheskii zhurnal SSSR (Moskva), 48 (11): 1332-1341. 1962. In Russian.

Seated subjects were required to hold measured weights in the palm of a hand. Their arms were placed in a horizontal position and supported to insure immobility. EEG and EMG measurements were taken. The results show that the extension of the biceps brachii muscle causes stimulation of the cortical end of the muscle analyzer. The α-rhythm is blocked, and desynchronization of the high-frequency and, in most cases, of the low-voltage waves occurs. The desynchronization increases to a certain limit beyond which an increase of stimulation results in a decrease of desynchronization and in restitution of the α-rhythm. These changes in the EEG are accompanied by a sharp decline in bio-electrical activity of the muscle. The inhibitory function of the cerebrum causes muscular relaxation through the formatio reticularis (Sherrington's reaction), autogenic inhibition through the Golgi nerve organs of the tendons, and blocking of α-motor neurons in the brain. (28 references)

409
Ohara, K.,
and T. Ono
REGIONAL RELATIONSHIP OF WATER VAPOR PRESSURE OF HUMAN BODY SURFACE.—Jour. Applied Physiol., 18 (5): 1019-1022. Sept. 1963.

A new simple method for measurement of water discharge from the skin, as well as for estimation of absolute and relative humidity of the skin surface, is reported. The accuracy of the method is high with errors in the order of 2.5%. Estimations were made, using this method, at 108 points over the body of a young healthy nude male subject under neutral thermal conditions. There was no difference between the regional relationship of the insensible perspiration and that of the absolute humidity. In the regions where perspiration rate is high, the water vapor pressure of the skin surface is also high. Sole, face, palm, and neck are the highest regions. Back of hands and gluteal region are the second highest zones. In distal parts of extremities there exists an increasing gradient toward the palm or the sole. In the median region of the chest and epigastrium the values are somewhat higher though the chest and abdomen as a whole belong to the lowest regions. Distribution of the relative humidity showed no great difference in general from that of the perspiration rate or absolute humidity. It was found that the regional relationship is not perfectly symmetrical in both sides of the body. (From the authors' abstract)

410
Ozaki, T.,
K. Sato, T. Awazu, K. Mimura, N. Honda, S. Teramoto, and K. Kitajima
SOME OBSERVATIONS ON THE EFFECT OF SENSORY STIMULATION UPON MINOR TREMORS IN MAN.—Japanese Jour. Physiol. (Kyoto), 13 (1): 24-32. Feb. 1963.

The effects of rhythmic or random photic and sonic stimulations upon the so-called minor tremors (MT) of the human body surface were studied. MT were recorded simultaneously with the electroencephalogram and electrocardiogram. Study of the MT tracing, and cross correlation between the stimuli and MT showed that MT components which synchronize with the frequency of the stimulation were driven by rhythmic flash stimulation. In addition, increased regularity and rhythmicity of MT were found in the autocorrelogram of MT, even when the driven component of MT produced by stimulation was not evident on visual inspection. On the other hand, it was shown in the autocorrelogram that the damping of oscillation became faster by random flash stimulation. The same phenomena as those produced by photic stimulation were also demonstrated with rhythmic and random flash stimulation. It appears that the central process of the neuromuscular system such as augmentation and inhibition might be represented respectively by the increase and decrease of driven MT during various sensory stimulations, although ballistocardiographic oscillations are mixed in MT. (Authors' summary, modified)

411
Pavlova, E. B.
[CHANGES IN THE ANTERIOR LOBE OF THE HYPOPHYSIS IN RADIATION ACTION AND COOLING] Izmeneniia v perednei dole gipofiza pri luchevom vozdeistvii i okhlazhdenii.—Problemy endokrinologii i gormonoterapii (Moskva), 9 (3): 3-7. May-June 1963. In Russian, with English summary (p. 7).

Twenty-four hours after X-ray irradiation, at the period of maximum corticosterone secretion, there is a marked adrenal hypertrophy with the appearance of vacuolized delta-basophils in the anterior lobe of the hypophysis. Similarly, after three days of cooling of the experimental animals (rats) there is a hypertrophy of the adrenal glands, thymus involution, and vacuolization of the delta-basophilic cells of the hypophysis. Both these changes may be regarded as a morphological manifestation of intensified ACTH secretion in response to deleterious factors.

412
Ruščák, M.
CONDITIONED RESPONSE TO A RISE IN MUSCLE METABOLISM.—Activitas nervosa superior (Praha), 4 (3/4): 294-207. 1962. In English.

Signals conditioned to indicate the beginning of muscular work regularly produced an intensification of metabolic processes in the muscles of dogs, i. e. a rise in temperature and in the levels of lactic acid, sodium and potassium in the blood with a decrease of inorganic phosphates in the blood. These changes may be blocked by curare administration, except for the increase of sodium and potassium. It was shown that changes of the kaliemia corresponded closely to the activity of the muscles of the circulatory system. The author hypothesizes that the described conditioned effects are caused on the one hand by increased metabolism in the muscles themselves and, on the other, by the increased activity of the cardiovascular system.

413
Salomon, G.,
and A. Starr
ELECTROMYOGRAPHY OF MIDDLE EAR MUSCLES IN MAN DURING MOTOR ACTIVITIES.—Acta neurologica scandinavica (Copenhagen), 39 (2): 161-168. 1963. In English.

Electromyographic studies in man reveal the middle ear muscles to be active in association with general motor events such as eye closure, face and head movements, vocalization, yawning, swallowing, coughing, and laughing, These findings suggest that central mechanisms controlling a variety of motor events simultaneously govern middle ear muscles contractions. A full understanding of middle ear muscle function must take into account these prominent non-acoustic activities. (Authors' summary)

414
Tribukait, B.
[EXPERIMENTAL INVESTIGATIONS ON THE REGULATION OF ERYTHROPOIESIS WITH

SPECIAL CONSIDERATION OF THE IMPORTANCE OF OXYGEN] Experimentelle Untersuchungen zur Regulation der Erythropoiese unter besonderer Berücksichtigung der Bedeutung des Sauerstoffs.— Acta physiologica scandinavica (Stockholm), 58, Supplement 208. 47 p. 1963. In German.

A study was made of the changes in the total hemoglobin content, the relative blood values (arterial oxyhemoglobin saturation, arterial oxygen pressure), and the total blood volume of the rat during long-term stay at O_2 pressures between 760 and 50 mm. Hg; with artificially altered blood O_2 content; and with cobalt administration. The deciding factor for all regulatory changes of erythropoiesis appears to be the height of the O_2 pressure in the tissues. Deviations of tissue O_2 pressure from the normal evoke a change of the erythropoiesis only when they are due to lowered arterial O_2 content or pressure (anemia, hypoxia) or raised blood O_2 content (return to sea level after acclimatization to altitude). Increased oxygen needs of the tissue usually are met by increased circulation. Apparently O_2 lack does not constitute a direct stimulus for the bone marrow but is mediated through erythropoiesis-stimulating substances formed in the tissues. (115 references)

4. NEURO AND SENSORY PHYSIOLOGY

[Environmental effects under 6]

a. General

415

Barnard, G. W.,
C. B. Reifler, V. H. Thaler, W. P. Sullivan, and D. H. Brand

PERIOD ANALYSIS OF THE ELECTROENCEPHALOGRAM DURING SEQUENTIAL STRESSES: DATA ACQUISITION AND ANALYTICAL SYSTEM [Abstract].—Electroencephalography and Clinical Neurophysiol. (Amsterdam), 15 (1): 166. Feb. 1963.

A "system" approach is presented wherein a holistic psychophysiological assessment is made of individuals under resting conditions as well as sequential stress conditions. Two channels of EEG along with six other physiological parameters are recorded simultaneously. The subjects' autonomic responses are continuously recorded on magnetic tape as well as on paper. The raw data are transmitted by telephone lines to the analog-digital converter with the final computations performed by computer. To facilitate data handling, the EEG is converted to the number of major and minor periods per two seconds by means of a Burch Period Analyzer. For each of the 17 record periods, major and minor period counts are obtained with outputs of first, over-all, and last-minute means as well as standard deviations. In addition, highest and lowest levels of EEG activity measured in terms of periods and relative times at which these highest and lowest levels first occurred are obtained. Thus a graph of each subject's responses demonstrating his "identity" is prepared to further elicit response stereotypy. (Quoted in part)

416

Botwinick, J.,
and J. F. Brinley

AGE DIFFERENCES IN RELATIONS BETWEEN CFF AND APPARENT MOTION.—Jour. Genetic Psychol., 102 (2): 189-193. June 1963.

Thresholds of critical flicker fusion (CFF) and two types of apparent motion were obtained for groups of subjects. This was done to determine whether the thresholds were related, and if so, whether the pattern of relation was the same for both groups. One apparent motion threshold involved jugdment of any motion (AM_1) and the other involved judgment of a transit type of motion (AM_2). The subjects were 18-27 years old in one group and 63-80 years old in the other group. Statistically significant correlations were found between CFF and AM_1 in the old group, and CFF and AM_2 in the young group. (Authors' summary, modified)

417

Chkhaidze, L. V.

[SIGNIFICANCE OF DYNAMIC COMPONENTS IN THE CENTRAL REGULATION OF THE COORDINATION STRUCTURE OF LOCOMOTOR ACTS IN MAN] Znachenie dinamicheskikh sostavliaiushchikh v tsentral'noi reguliatsii koordinatsionnoi struktury lokomotornykh aktov u cheloveka.—Biofizika (Moskva), 7 (4): 460-467. 1962. In Russian.

The locomotor coordination in man is discussed and is subdivided into two phases: the first consists of the general awareness of the goal of motion, the second is subordinated to the first and consists of the concrete muscular synergies. The elements comprising both component phases are discussed on the basis of previously published experimental results. No original experimental data are reported.

418

Dahl, W. D.

BRAIN-WAVE MODIFICATION BY FLICKER. — Naval Research Reviews (Washington), p. 15-17. June. 1962.

An Alpha Rhythm Feedback Control Unit has been designed to aid in determining the validity of the following hypothesis: if a photic stimulation is applied at the proper time during each cycle of the alpha rhythm of the electroencephalographic waves, the alpha rhythm will be reinforced. The equipment is being tested and may prove of great value in the diagnosis of epilepsy, brain lesions, and other pathological conditions. The relationship between behavior and the alpha rhythm, in the presence of flicker, has military implications. For example, under certain conditions, sunlight shining through the rotating blades of a helicopter produces a flicker in the alpha frequency range. In this situation, rhythmic low-frequency tactile stimulation is produced by means of vibration.

419

Duensing, F.,
K. P. Schaefer, and C. Trevisan

[THE ROLE OF THE NEURONS TRANSMITTING INFORMATION WITH REGARD TO ROTATION IN THE CENTRAL FUNCTIONAL SYSTEM OF THE LABYRINTHINE POSTURAL REFLEXES OF THE HEAD AND EYES] Die Raddrehung vermittelnden Neurone in der zentralen Funktionsstruktur der Labyrinthstellreflexe auf Kopf und Augen.—Archiv für Psychiatrie und Nervenkrankheiten (Berlin), 204 (2): 113-132. 1963. In German.

The function of the nucleus interstitialis is elucidated from findings of registration of potentials from single neurons in the rabbit brain during labyrinthine stimulation and on the basis of analysis of the afferents and efferents of the nucleus interstitialis and the demonstrated effects of electrical stimulation. The interstitial nucleus is considered to be a special nucleus in the wide-spread functional system of the reflex head and eye movements, subservient to the coordination of optical and vestibular signals. The efference in response to the integral of various afferences causes the reflex rotation of the eyes, head, and trunk around the longitudinal axis or vertical movements which give at the same time constancy of the outside world in the process of visual perception and the correct position of the individual with respect to the Earth's gravitational field.

420
Ebe, M.,
T. Mikami, M. Aki, and M. Miyazaki
ELECTRICAL RESPONSES EVOKED BY PHOTIC STIMULATION IN HUMAN CEREBRAL CORTEX.—Tohoku Jour. Exper. Med. (Sendai), 77 (4): 352-366. Sept. 25, 1962.

The potentials evoked in the occipital area of the cortex by photic stimulation were studied by means of the superimposition method of Dawson in 90 subjects between the ages of 4 and 84. While subjects kept their eyes open in a dark room, the photic stimulation was applied during the period of suppressed electroencephalography. It was demonstrated that eye blinking and the electroretinogram (ERG) did not interfere with recording of the potentials. Although the ERG was very small in the photopic state, evoked potentials were normally observed. In spite of the decrease in scotopic ERG on the primary pigment degeneration of the retina, evoked potentials were well demonstrated. On the contrary, scotopic ERG was clearly observed on optic nerve atrophy, and evoked potentials did not appear. The evoked potentials of the subjects were classified according to four groups: (1) showing initial positive waves; (2) without initial wave; (3) without both first and second waves; (4) with more dominant sixth wave rather than fourth wave. No correlation between the evoked potentials and the pattern of spontaneous activity in the stage of arousal was observed. The culmination time of each component was more prolonged with increasing age, and the amplitude increased in both young and old as compared with intermediate age. (Authors' summary, modified)

421
Ebe, M.,
and T. Mikami
CORTICAL EVOKED POTENTIALS DUE TO PHOTIC STIMULATION DURING SLEEP IN MAN.—Tohoku Jour. Exper. Med. (Sendai), 77 (4): 383-389. Sept. 25, 1962.

Evoked potentials were recorded in 37 normal subjects, 4-61 years of age, asleep supine in a dark room, by the superimposition method of Dawson using a cathode-ray oscilloscope and electroencephalograph as monitor. The evoked potentials recorded from the surface of the head by photic stimulation were shown to change according to the stage of sleep. During sleep the culmination times of the evoked potentials were prolonged. After induction of sleep the third positive wave increased in amplitude, but decreased again in deep sleep. The fourth negative wave, at first, decreased in amplitude, but in the proceeding stages developed to the dominant component covering the sixth negative wave and became larger than in arousal. In most cases, the stage of sleep determined by the pattern of the evoked potentials coincided with the stage determined by the pattern of spontaneous activity. During sleep the evoked potentials were localized in the occiput, but the secondary response as arousal reaction was widely distributed from forehead to occiput and showed the maximum amplitude on the parietal area. (Authors' summary, modified)

422
Ebe, M.,
and T. Mikami
THE EFFECTS OF THE INTENSITY OF PHOTIC STIMULATION ON CORTICAL EVOKED POTENTIALS IN AROUSAL AND DURING SLEEP.—Tohoku Jour. Exper. Med. (Sendai), 78 (1): 17-24. Oct. 25, 1962.

Ten normal subjects between 8 and 41 years of age were exposed to a stimulating light from a white Xenon lamp, 50 microseconds in duration and 0.3 Joule/second in electric energy. The subjects gazed at a small, faint red light in the center of a stimulating light arranged in the distance of 30 cm. in front of the eyes. Recordings were made with the cathode ray oscilloscope, electroencephalograph, and electroretinograph. In arousal, the changes of the evoked potentials following reduction of the intensity of the stimulating light were categorized into three types: delay of culmination time, decrease of amplitudes, and shift of the prominent component. Cortical spontaneous activities became slow and synchronized during sleep, as the activities were released from the control of the activation mechanism of the reticular formation. The excitability of cortical cells decreased during sleep, since the threshold of the potential evoked by light stimulation was higher, over 10^3-fold, than in arousal. That the amplitude of the potential evoked during sleep was larger than in arousal may be due to a tendency of synchronization in the cortical cells.

423
Edelberg, R.
INFLUENCE OF COOLING OF ADJACENT AREAS ON GSR AND BASE RESISTANCE OF AN ISOTHERMAL SITE.—Baylor Univ. Coll. of Medicine, Houston, Tex. (Contract AF 41(609)-1527); issued by School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775102). Technical Documentary Report no. SAM-TDR-63-70, Sept. 1963. iii+7 p.

In a simulation of possible field conditions, skin resistance (R) and galvanic skin response (GSR) were measured from finger sites maintained at constant temperature while adjacent areas were cooled and rewarmed. Cooling of restricted areas up to 10 cm. from the isothermal site produced negligible changes in R and variable effects on GSR amplitude. Cooling the entire hand surface to 15°C. caused an initial increase in GSR amplitude followed by a steady decline to levels as much as 50% below control while R showed only minor changes. GSR count was also altered. Results are interpreted in terms of a two-component system influencing R and GSR. It is concluded that adequate technic demands maintenance of a narrow temperature range over the entire hand or foot. (Authors' abstract)

424
Gmyria-Novi, V. A.
[STUDY OF INDUCED POTENTIALS AND EEG OF THE AUDITORY AREA DURING THE CHANGED FUNCTIONAL STATE OF THE CEREBRAL CORTEX DUE TO MUSCULAR EXERTION] Doslidzhennia vyklykanykh potentsialiv i EEG slukhovoi dilianky pri zmini funktsional'nogo stanu kory golovnogo mozku v zv'iazku z m'iazovym napruzhenniam.—

Fiziologichnyi zhurnal (Kyiv), 9 (2): 189-196. March-April 1963. In Ukrainian, with English summary (p. 196).

Prolonged exposure of dogs to sharp sound stimulation resulted in appearance of slow response potentials originating in the auditory area of the cortex. The degree of response varied with the functional state of the cerebral cortex which was influenced by muscular exertion. Exertion of animals untrained in carrying loads resulted in an increased amplitude and indices of rapid response potentials, while the slow waves were inhibited. As the training progressed, the slow waves became more pronounced, the fast waves, however, were also clearly expressed. Heavy loads caused a leveling off in the cerebral bioelectric activity, the slow waves appeared, while the incidence of response potentials decreased. It is concluded that the optimum conditions for the registration of the cerebral response potentials should correspond to the optimal functional state of the cerebral cortex as expressed by the well-defined main brain waves and rapid potentials, which could be expressed as independent oscillations.

425
Il'ianok, V. A.
[EFFECT OF THE DURATION OF RHYTHMICAL LIGHT FLASHES AND OF THE INTERVALS BETWEEN THEM ON THE ELECTROENCEPHALOGRAPHIC RHYTHMS IN MAN] Vliianie dlitel'nosti ritmicheskikh svetovykh vspyshek i intervalov mezdu nimi na vosproizvedenie ritmov mozgom cheloveka.—Biofizika (Moskva), 6 (6): 711-716. 1961. In Russian.

Seven test subjects were exposed to light flashes alternating with periods of darkness, having ratios of 1:9, 1:3, 1:1, 1:0.3, and 1:0.09. When the light flashes were of long duration and the dark intervals were short, the amplitudes of the brain waves were minimal. Maximal amplitudes appeared following short flashes and long periods of darkness. The elicited brain wave frequencies were as follows: low frequencies (4-12 cycles/sec.), at light-dark ratio 1:3; medium frequencies (20-30 c.p.s.), at 1:1; and high frequencies (60 c.p.s.), at 1:03. It is concluded that the changes in the duration of light flashes and the intervals between them affect significantly the shape and amplitude of the response potentials of the brain.

426
Ivanova, M. P.
[THE EFFECTS OF HYPERVENTILATION AND BREATH-HOLDING ON BIOELECTRIC CEREBRAL ACTIVITY] Vliianie giperventiliatsii i zaderzhki dykhania na bioelektricheskuiu aktivnost'mozga.—Teoriia i praktika fizicheskoi kul'tury (Moskva), 26 (1): 19-21. Jan. 1963. In Russian.

No electroencephalographic changes were observed due to hyperventilation. However, slow waves appeared when hyperventilation preceded muscular exertion. In both cases there was an increase in pulse rate followed by apnea. The motor-conditioned response to a light stimulus before and after hyperventilation was as follows: in general, there was an increase in the latent period of the motor response and in the depression phase of the α-waves. Breath-holding in itself did not cause appearance of slow waves; but they were present after muscular exertion.

427
Nelson, D. O.,
and L. W. Finch
EFFECT OF AUDIO-ANALGESIA ON GROSS MOTOR PERFORMANCE INVOLVING ACUTE FATIGUE. — Research Quarterly, 33 (4): 588-592. Dec. 1962.

The purpose of this investigation was to study the effect of selected sounds (audio-analgesia) on an all-out 60-second ride on the bicycle ergometer. Sixteen subjects were used in a 4 x 4 Latin square design. Sounds were (a) fast march music, (b) slow music, (c) white sound with a mambo background, and (d) no sound. No significant differences were found among the results of the experimental variables. (Authors' abstract)

428
Nelson, P. G.,
and K. Frank
INTRACELLULARLY RECORDED RESPONSES OF NERVE CELLS TO OXYGEN DEPRIVATION.—Amer. Jour. Physiol., 205 (1): 208-212. July 1963.

Transmembrane potentials of cat motoneuron somata were recorded with concentric microelectrodes (one inside and one outside, 20-40 μ apart) during several minutes of anoxia by artificial respiration with nitrogen or by asphyxia. Both large and small changes in membrane potential—some spontaneously reversible—were seen following 0.5-5 minutes of anoxia or asphyxia. Most large and many smaller changes were correlated with transient blood pressure changes. Sometimes membrane potential could be restored by mechanical adjustment of the micropipette. Especially when blood pressure was stabilized with an infusion of hexamethonium chloride, some motoneurons could withstand 4-5 minutes of anoxia or asphyxia with membrane potential changes of no more than 2-5 microvolts, close to the limit of significance with this technique. Some small potential changes may be the direct effect of hypoxia on motoneuron membrane or of a change in interneuron background activity, but after eliminating the effects of electrode movement the motoneuron is remarkably insensitive to anoxia. (Authors' abstract)

429
Samsonova, V. G.
[PECULIARITIES OF THE DAY AND TWILIGHT VISION IN MAN AS REFLECTED IN THE TOTAL ELECTRICAL ACTIVITY OF THE BRAIN] Otrazhenie v summarnoi elektricheskoi aktivnosti mozga osobennostei dnevnogo i sumerechnogo zreniia cheloveka.—Biofizika (Moskva), 8 (3): 374-379. 1963. In Russian.

Electroencephalograms were obtained of six subjects exposed to pulses of white, red, or blue light with a light-dark ratio of 1:1 and frequency of 6, 14, or 40 c.p.s. When the brightness was 0.4 lux or more, the amplitude of the brain waves increased regardless of the color used, although the intensity of the reactions varied. Stimulation with blue light of 0.4 to 2-6 lux resulted in an increased amplitude of the brain waves, while a further increase in light intensity caused a reduction in the amplitude. Red light stimulation of 0.4 up to 50 lux, on the other hand, resulted in a progressive increase of the amplitudes.

430
Sickel, W.
[THE HUMAN ELECTROENCEPHALOGRAM AFTER SEVERAL HOURS OF MENTAL WORK] Über das menschliche Elektroenzephalogramm nach mehrstündiger psychischer Aktivität.—Archiv für die gesamte Psychologie (Frankfurt am Main), 114 (1): 1-54. April 1962. In German, with English summary (p. 52).

An attempt was made to establish quantitative and qualitative alterations in the electroencephalographic activity following predominantly mental activity as contrasted with physical activity. A total of 90 subjects of both sexes were investigated. In general, after predominantly mental activity there were less alpha waves, more beta waves, and more theta waves in the electroencephalograms than before; the different types of waves changed more often. After predominantly physical activity for six hours there were similar but much less marked alterations in the electroencephalograms. These were considered to be the result of mental activity which accompanies all physical activity. After a day of leisure no alterations in the electroencephalograms could be demonstrated. A higher level of mental activity was followed by more pronounced changes in the EEG. The alterations in EEG after mental activity were considered to be effects of the mental activity, which lasts longer than the actual intellectual task used to produce the mental activity. (Author's summary, modified) (39 references)

431
Stewart, J. L.
QUANTITATIVE LAWS FOR SENSORY PERCEPTION. — Psychol. Rev., 70 (2): 180-192. March 1963.

A model for subjective intensity derived from an elementary sensor provides linear filtering, rectification with variable power law exponent, and finite time averaging. The model is consistent with the physiological measure of average neural pulse rate. Simplified mathematical representations are employed to explain partial and complete masking. The Stevens law and a modified Weber law are derived as special cases. When extended to an array of sensors, a broadly significant pattern theory for recognition results which explains diplacusis and other phenomena. Direct electronic simulation may be achieved (and has) so as to yield solutions to problems which are too complex to be analyzed in other ways. (Author's summary)

432
Stuart, D. G.
ANATOMY OF THE HYPOTHALAMUS AND ITS CONNECTIONS.—Univ. of California. School of Medicine, Los Angeles (Contract AF 41(657)-344); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-22). Technical Documentary Report no. AAL-TDR-62-13, Sept. 1962. iii+20 p.

This report briefly summarizes hypothalamic anatomy in terms of boundaries, cellular groups, intra, efferent and afferent connections, and ontogenetic development, Wherever possible, discussion is directed or limited to aspects of hypothalamic anatomy that are of special significance to the nervous control of shivering. For this reason the connections between the septal area of the forebrain and the hypothalamus are emphasized. (Author's abstract) (65 references)

433
Stuart, D. G.,
Y. Kawamura, and A. Hemingway
SEPTAL AND HYPOTHALAMIC STIMULATION OF UNANESTHETIZED CATS.—Univ. of California. School of Medicine, Los Angeles (Contract AF 41(657)-344); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-22). Technical Documentary Report no. AAL-TDR-62-14, Sept. 1962. iii+21 p.

Bipolar stainless steel electrodes were stereotactically implanted in septal and hypothalamic loci in six cats. Observations were made of autonomic, somatomotor, and behavioral responses to electrical stimulation delivered while the cats were unanesthetized and unrestrained. Septal stimulation evoked sympathetic and parasympathetic responses in varying combination on various days. This suggested that responses to septal stimulation were influenced by the relative excitability of anterior and posterior hypothalamic neurons at a given time. Shivering was produced during stimulation of both septal and hypothalamic loci, thereby confirming previous results obtained from anesthetized preparations. (Authors' abstract)

434
Stuart, D. G.,
W. J. Freeman, and A. Hemingway
EFFECTS OF DECEREBRATION AND DECORTICATION ON SHIVERING IN THE CAT. — Univ. of California. School of Medicine, Los Angeles (Contract AF 41(657)-344); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-22). Technical Documentary Report no. AAL-TDR-62-15, Sept. 1962. iii+17 p.

The effects of decerebration and decortication on the metabolic intensity of shivering in cats were determined. There was neither shivering nor an appreciable rise in the oxygen consumption rate of chronic decerebrate cats during rapid cooling. The intermittent somatomotor activity that was induced by rapid cooling was occasionally tremulous but it was also evoked by rapid warming and was absent during slow cooling and warming. This suggested that the motor activity of decerebrate cats during rapid cooling was more a generalized avoidance response to nociceptive stimulation than a temperature-regulating mechanism. In decorticate cats shivering was depressed three days after surgery, the mean shivering to nonshivering ratio of oxygen consumption rate being 1.6 ± 0.12 (S.D.), while the same ratio before operation was 2.6 ± 0.48 (S.D.). One month after decortication shivering had returned to its pre-operative intensity. This suggested that the net telencephalic influences on shivering could hardly be suppressive, as suggested by some earlier investigators. (Authors' abstract) (29 references)

435
Stuart, D. G.,
Y. Kawamura, and A. Hemingway
ACTIVATION AND SUPPRESSION OF SHIVERING DURING SEPTAL AND HYPOTHALAMIC STIMULATION.—Univ. of California. School of Medicine, Los Angeles (Contract AF 41(657)-344); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-22). Technical Documentary Report no. AAL-TDR-62-16, Sept. 1962. iii+36 p.

In acute experiments on 38 lightly anesthetized cats, the septal region of the forebrain and the hypothalamus were explored for loci whose activation by electrical stimulation produced, suppressed, or failed to affect shivering. Shivering was consistently and repeatedly produced by stimulation of the dorsomedial region of the posterior hypothalamus, and sometimes by stimulation of the ventrolateral region of the septum. A greater intensity of stimulus was needed to produce more latent and less intense shivering during septal than during hypothalamic stimulation. Similarly, more intense stimulation was necessary to suppress shivering during ventromedial septal stimulation than during anterior, or ventrolateral posterior hypothalamic stimulation. The most effective stimulation frequency for both activation and suppression of shivering was 50 pulses/sec., i.e. fivefold the evoked or suppressed limb tremor frequency. On the basis of these results it was concluded that septal influences on shivering are secondary to a primary hypothalamic modulation of this tremor. Such modulation appears to be more concerned with initiation and maintenance than with the rhythm of shivering. (Authors' abstract) (57 references)

436
Stuart, D. G.,
Y. Kawamura, A. Hemingway, and W. M. Price
EFFECTS OF SEPTAL AND HYPOTHALAMIC LESIONS ON SHIVERING.—Univ. of California. School of Medicine, Los Angeles (Contract AF 41(657)-344); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-22). Technical Documentary Report no. AAL/TDR-62-18, Sept. 1962. iii+14 p.

Shivering and heat loss in the cold were determined in 46 cats several weeks or months after bilateral destruction of various septal and hypothalamic regions. Septal lesions had no effect on either parameter. The tremor was abolished or markedly reduced in cats with lesions in the dorsomedial region of the posterior hypothalamus, but postural, pilomotor, and behavioral responses to cooling persisted. Lesions of the dorsolateral region of the posterior hypothalamus increased heat loss despite the presence of shivering, huddling, and piloerection. These results confirmed previous electrical stimulation data that the primary region controlling the efferent (motor) aspect of shivering is the dorsomedial region of the posterior hypothalamus and additionally indirectly suggested that the dorsolateral region of the posterior hypothalamus is implicated in cold-induced cutaneous vasoconstriction. (Authors' abstract) (28 references)

b. Vision

[*Eye examination under 8-f*]

437
Alpern, M.,
and F. W. Campbell
THE BEHAVIOR OF THE PUPIL DURING DARK-ADAPTATION [Abstract].—Jour. Physiol. (London), 165 (1): 5P-7P. Jan. 1963.

The theory of dark-adaptation leads to the expectation that the amount of unregenerated rhodopsin continually transmits messages indicating the state of recovery of visual purple. Using photographic techniques evidence for such messages was studied. In three subjects it was found that when the light stimulus was turned off, the pupil showed three distinct and reproducible phases. Initially there was a dilatation to an intermediate size that was achieved in approximately 10 seconds. This was followed by a constriction, the pupil reaching a minimum size in approximately 30 seconds. Finally, there was a dilatation of a slow nature. This third phase appears to return to the fully dark-adapted level along a curve very similar to that of rod dark adaptation. By appropriate light adaptation to blue and orange fields matched for either photopic or scotopic vision, it was shown that all three phases were dominated by rods. It is concluded that signals related to the amount of unregenerated rhodopsin reach the central nervous even in total darkness. (Authors' abstract, modified)

438
Alpern, M.
SIMULTANEOUS BRIGHTNESS CONTRAST FOR FLASHES OF LIGHT OF DIFFERENT DURATIONS. — Investigative Ophthalmol., 2 (1): 47-54. Feb. 1963.

Measurements were made of the magnitude of simultaneous brightness contrast on two young adult male observers by a binocular brightness matching method. Five different luminances of the inducing pattern were studied and the duration of the exposure was varied between 5 and 150 milliseconds along an arithmetic scale. For low inducing flash luminances, the longer exposures show the greater contrast effect. However, as the luminance of the inducing pattern was progressively increased, the duration of exposure showing the largest contrast effect systematically decreased. The curves resemble the Broca-Sulzer curves both in the manner, at any given luminance, that the ordinate varies with duration and in the way any given curve changes as luminance is varied. The data explain a previous contradiction between results from psychophysical and electrophysiological experiments and therefore greatly strengthen physiological theories of contrast. (Author's summary)

439
Arden, G. B.,
and J. H. Kelsey
CHANGES PRODUCED BY LIGHT IN THE STANDING POTENTIAL OF THE HUMAN EYE. — Jour. Physiol. (London), 161 (2): 189-204. May 1962.

The standing potential across the human eye was measured by placing skin electrodes near the two canthi, and recording the changes in potential occurring when the eye rotated through a fixed angle. When retinal illumination was reduced, the potential fell to a fixed lower level, which was independent of the previous potential value (the dark trough level). The size of the fall was independent of the duration and the degree of the reduction of illumination, and was succeeded by slow prolonged potential oscillations. Re-illumination of the dark-adapted eye caused a large rise of potential, the magnitude of which varied with the logarithm of retinal illumination, and the duration of dark adaptation. The experiments demonstrate that though two separate processes cause the dark trough and light rise, there is probably only one generator of that fraction of the standing potential which can be affected by change in retinal illumination. (From the authors' summary) (25 references)

40
rden, G. B.,
and J. H. Kelsey
SOME OBSERVATIONS ON THE RELATIONSHIP BETWEEN THE STANDING POTENTIAL OF THE HUMAN EYE AND THE BLEACHING AND REGENERATION OF VISUAL PURPLE. — Jour. Physiol., (London), 161 (2): 205-226. May 1962.

The light-induced change in the corneo-fundal potential (the light rise) varies linearly with log retinal illumination in the range of 20-10,000 trolands. Higher illumination causes no further increase. The action spectrum of the light rise shows that the potential change is initiated by the activity of the rods. The size of the light rise is dependent upon the length of prior dark-adaptation, during which a "recovery process" occurs exponentially with a half-time of 5 minutes. The light rise cannot occur in the ischaemic eye. Observations on diseased eyes provide evidence that the potential changes studied occur in the pigment epithelium and are not related to retinal nervous activity. The experiments are discussed and an attempt is made to relate the potential changes to the biochemistry of visual purple. (Authors' summary)

41
rduini, A.,
and L. R. Pinneo
PROPERTIES OF THE RETINA IN RESPONSE TO STEADY ILLUMINATION.—Archives italiennes de biologie (Pisa), 100 (4): 425-448. Oct 5, 1962. In English.

In 85% of nembutal-anesthetized cats tested, tonic activity in the retina, as measured by gross electrodes in the optic chiasm, decreased with increases in the level of steady illumination. The change in activity was related to the intensity of illumination by an inverse power function. In 15% of nembutal-anesthetized cats, the tonic activity in the retina was enhanced when the level of steady illumination was raised. The change in activity in these animals was always related to the dark discharge just prior to stimulation. When the signal-to-noise (S/N) ratio was below 1.45, there was an increase with light; if in the same animals, the S/N ratio of the dark discharge was above 1.45, there was a decrease with light. These results were also found in unanesthetized pre-trigeminal preparations and in precollicular decerebrate preparations. In the pretrigeminal cats with S/N ratios below the reversal threshold, the level could be increased by repeated light stimulation, reversible deafferentation by retinal ischemia due to increased intraocular pressure, or by injections of small doses of nembutal. It is concluded that tonic retinal activity is functionally related to several aspects of the visual process. Possible mechanisms of control of tonic retinal activity are discussed. (Authors' summary, modified) (28 references)

442
Averbach, E.
THE SPAN OF APPREHENSION AS A FUNCTION OF EXPOSURE DURATION.—Jour. Verbal Learning and Verbal Behavior, 2 (1): 60-64. July 1963.

This study examined the span of apprehension, defined as the limit of the number of independent units of visual information that can be processed simultaneously, as a function of exposure time. The results show that the span of apprehension rises rapidly with increasing exposure time then it bows and almost levels off. It involves sequential processes in addition to parallel processing of the visual information. The subject's efficiency at utilizing his time for processing of dots decreases markedly for exposure times above 100 milliseconds. The two hypotheses offered to explain the decay above 100 milliseconds are in terms of limitations imposed on discrimination, and of limitations imposed on short-term memory storage, respectively.

443
Ayres, J. J.,
and E. R. Harcum
DIRECTIONAL RESPONSE-BIAS IN REPRODUCING BRIEF VISUAL PATTERNS. — Perceptual and Motor Skills, 14 (1): 155-165. Feb. 1962.

Ten observers reproduced 10-element binary patterns flashed across fixation along the horizontal meridian. After the pattern was exposed, observer was instructed to reproduce the pattern from left to right, right to left, center out, or to use any of the above three sequences at his option. Given an option, nine of the 10 observers consistently marked the responses from left to right. Observers made fewer errors on the left with left-to-right sequences than with right-to-left sequences. Marking responses from the center of the pattern, i.e., near fixation, out toward the ends of the pattern resulted in error-functions which were generally between those for right-to-left and left-to-right sequences. The effects of response-sequence, which are explained in terms of traces or afterimages which fade while observer is reproducing the pattern, cannot alone account for the hemifield-differences. A perceptual factor apparently corresponds to a sequential analysis of the trace or afterimage.

444
Baldwin, R. D.,
D. J. Chambliss, and A. D. Wright
TARGET DETECTABILITY AS A FUNCTION OF TARGET SPEED, NOISE LEVEL, AND LOCATION. — Jour. Applied Psychol., 46 (1): 26-30. Feb. 1962.

An experiment was conducted using a PPI radar display on which 40 subjects observed targets displayed in each of 4 contiguous 30-degree scope sectors at each of 4 radial velocities under 2 levels of visual noise. Analysis of variance of the mixed latin-square design did not reveal reliable differences in scores due to velocity, noise level, or velocity orders. More target designations occurred for the inner than the outer contiguous scope sectors ($p = .001$), although the ratios of correct to total calls per sector were not different ($p > .05$). These results were interpreted as being due to differences in scan frequency rather than reinforcement frequency. (Authors' summary)

445
Bartley, S. H.,
T. M. Nelson, and E. M. Soules
VISUAL ACUITY UNDER CONDITIONS OF INTERMITTENT ILLUMINATION PRODUCTIVE OF PARADOXICAL BRIGHTNESS. — Jour. Psychol., 55 (1): 153-163. Jan. 1963.

As brightness induced by intermittent stimulation increases, visual acuity worsens. As brightness induced by intensity increases, visual acuity improves. Thus brightness induced by these two means does not have summative but counter effects. This generalization refers only to ranges of intensity, etc., producing brightness enhancement and the intermediate range. The results suggest that the optic pathway operates to determine visual acuity under intermittent stimulation according to the alternation-of-response theory, i.e., the brightness varies in accord with the number of channels simultaneously activated. (Authors' summary, modified)

446
Baumgartner, G.,
and P. Hakas
[NEUROPHYSIOLOGY OF THE SIMULTANEOUS BRIGHTNESS CONTRAST: RECIPROCAL REACTIONS OF ANTAGONISTIC NEURON GROUPS IN THE VISUAL SYSTEM] Die Neurophysiologie des simultanen Helligkeitskontrastes: reziproke Reaktionen antagonistischer Neuronengruppen des visuellen Systems. — Pflügers Archiv für die gesamte Physiologie (Berlin), 274 (5): 489-510. 1962. In German.

The electrophysiological behavior of light-sensitive neurons in the optical tract, the lateral geniculate bodies, and the visual cortex (area 17) is described in reference to simultaneous brightness contrast. Under these conditions light-sensitive neurons are differentiated into two types depending upon whether they are excited by relative or absolute increase and/or decrease in brightness of their receptor field. The two types exhibit antagonistic behavior and have the same frequency distribution. Neurons of the optical tract and the geniculate bodies react similarly to contrast. Cortical neurons react with greater difference to diffuse illumination and maximum contrast. Activation of the different types of neurons in simultaneous brightness contrast correlates with brightness perception under similar conditions.

447
Biersdorf, W. R.,
and J. C. Armington
THE EFFECTS OF CHROMATIC PRE-EXPOSURE UPON DARK ADAPTATION OF THE HUMAN ELECTRORETINOGRAM. — Jour. Compar. and Physiol. Psychol., 55 (2): 161-167. April 1962.

The spectral sensitivity of the human electroretinogram (ERG) was investigated during the first two minutes of dark adaptation. Colored high-luminance pre-exposures were employed. The electroretinograms were recorded in response to brief chromatic test flashes once every second. The sensitivity of the ERG increased more rapidly during dark adaptation at 500 $m\mu$ than in other parts of the spectrum. The positive wave of the ERG was analyzed into two peaks neither of which represented pure photopic nor pure scotopic activity. Strong selective effects depending upon the color of pre-exposure were found in various portions of the spectrum. In addition to the scotopic and red photopic components, analysis suggested at least one additional photopic component. (Authors' summary)

448
Bittini, M.
SUBJECTIVE SHARPNESS AND CONTRAST THRESHOLD. — Atti della Fondazione Giorgio Ronchi (Firenze), 17 (4): 387-395. July-Aug. 1962. In English.

The threshold of visibility and the threshold of subjective sharpness of objectively sharp contoured targets were determined at various luminance levels. The subjective sharpness threshold relative to the corresponding contrast threshold is constant at photopic levels, while, in the range of scotopic luminances, it increases with decreasing luminance. (Author's summary)

449
Blough, D. S.,
and A. M. Schrier
SCOTOPIC SPECTRAL SENSITIVITY IN THE MONKEY.—Science (Washington), 139 (3554): 493-494. Feb. 1963.

Three rhesus monkeys learned to adjust a small illuminated spot to threshold intensity. Then, while dark adapted, they "tracked" their thresholds to stimuli spaced across the visible wavelength spectrum. Spectral sensitivity functions were determined for each animal from these threshold records. The functions agreed well with results obtained from a human subject in the same apparatus, and with the standard human scotopic function defined by the International Commission on Illumination. However, the monkeys' relative sensitivity was slightly higher in the long-wavelength portion of the spectrum. (Authors' abstract)

450
Bouman, M. A.,
and J. ten Doesschate
THE MECHANISM OF DARK-ADAPTATION. — Vision Research, 1 (5/6): 386-403. Jan. 1962.

An analysis is given of the various possible components of the dark-adaptation process. A distinction is made between photochemical component (f_1), neural receptor component (f_2), spatial summation component (D), temporal summation component (T), and a quantum coincidence component (k). These various components partly reveal themselves in different ways in dark-adaptation curves obtained by sensitivity measurements as a function of time for different target-sizes, different target-colors, and different retinal locations. Experiments were carried out in order to study the relative contribution of each component for foveal as well as for peripheral vision. Foveal adaptation appears to be governed by the component f_1 and perhaps also f_2. In phase I of peripheral adaptation a small D-component is added and in phase II of peripheral adaptation only the k-component is active. The behavior of the resting potential of the human eye during dark-adaptation does not bear a simple relation to any of the neural components mentioned in the present paper. (Authors' abstract)

451
Bourassa, C. M.,
and S. H. Bartley
A STUDY OF THE POSSIBLE EFFECT OF DIFFERENTIAL LIGHT ADAPTATION ON MEASURES OF BRIGHTNESS ENHANCEMENT.—Jour. Psychol., 56 (2): 435-440. Oct. 1963.

The phenomenon of brightness enhancement which has been generally accounted for by the timing given to the intermittent photic input, is explored for possible effects of light adaptation. The results support the hypothesis that brightness enhancement is a genuine phenomenon which cannot be accounted for primarily by light adaptation.

452
Brink, G. van den
SUBJECTIVE BRIGHTNESS DURING DARK-ADAPTATION. —— Vision Research (Oxford), 2 (Dec.): 495-502. 1962.

The course of dark-adaptation was studied with threshold measurements and with measures of the luminance required to maintain a constant supraliminal brightness. A stimulus in the light-adapted right eye was matched in brightness to a stimulus presented to the left eye, which was dark-adapted. The usual transition from cone to rod function observed in threshold measurements was also observed in curves of constant subjective brightness, provided the brightness was of the order of 1 bril, or a luminance in the dark-adapted eye of 40 decibels (1.0 microlamberts). The brightness function (operating characteristic) produced by light-adaptation plus recovery does not correspond identically to the characteristic produced by adaptation to a lower luminance, although the characteristic curves may be rather similar when only cone vision is involved. (Author's abstract)

453
Brown, K. T.
COMPLETE INTEROCULAR TRANSFER OF AN ADAPTATION PROCESS RESPONSIBLE FOR PERCEPTUAL FLUCTUATIONS WITH AN AMBIGUOUS VISUAL FIGURE. —— Vision Research (Oxford), 2: 469-475. Nov. 1962.

The rate of apparent change (RAC) was determined for the perceptual fluctuations which occur with a moving ambiguous figure. The RAC increased with viewing time, attaining a maximum after about 3 min. This increase of RAC with viewing time, during monocular observation, transferred 100% to the contralateral eye. The complete interocular transfer indicates that the physiological process which causes perceptual fluctuations is not located in the retina but in a central pathway common to the two eyes. This physiological process appears to be a type of neural adaptation which affects a given perception only during the time when that perception is occurring. This central adaptation process is most dramatically demonstrated with ambiguous stimuli, because of the resulting perceptual rivalry, but the process probably operates to some extent in all visual sensations and perceptions. Its possible role in other visual phenomena, such as the disappearance of stabilized retinal images, is discussed. (Author's abstract)

454
Chaikin, J. D.,
H. H. Corbin, and J. Volkmann
MAPPING A FIELD OF SHORT-TIME VISUAL SEARCH.—Science (Washington), 138 (3547): 1327-1328. Dec. 21, 1962.

Five female subjects in a dimly lighted room looked with both eyes at a fixation point on a large white screen located nine feet ahead of them. The binocular field of vision during short-time search of a stimulus matrix was mapped and found to be ovaloid, with the longer axis horizontal and with the center of the field above the fixation point. The field expanded in area as a function of exposure time, and there were frequent irregularities in its shape. (Authors' abstract, modified)

455
Clarke, F. J. J.,
and S. J. Belcher
ON THE LOCALIZATION OF TROXLER'S EFFECT IN THE VISUAL PATHWAY. —— Vision Research, 2 (Jan.-April): 53-68. Jan.-April 1962.

An attempt was made to establish the possible seat of Troxler's Effect in the visual pathway (after fixation of a target for a few seconds the objects in the outer visual field tend to fade out or disappear completely). Fully dark-adapted observers viewed a 4.1×10^{-5} cd/m.^{2} stimulus at 20° eccentricity under conditions of steady fixation, the mean time of subjective disappearance being 6.4 seconds. A consideration of quantum statistics and the kinetics of local adaptation at this low level shows that the effect cannot originate in the primary receptors. An experiment involving saccadic displacements of a faded image in the light-adapted condition yielded a frequency-of-seeing curve of Poissonian form, with n=3. From this it is deduced that at least three of the functional units involved need to respond to enable a faded image to reappear, and that the mean diameter of the unit at 20° eccentricity is 10 minutes of arc under these conditions. A study of extrafoveal acuity under equivalent conditions yielded a value of 8' of arc, indicating that the functional units involved are probably the same, the ganglionic units. As at least three units at a time seem to be concerned with Troxler's Effect, this indicates a post-retinal origin. A further experiment showed that there was no binocular interaction of Troxler's Effect, which suggests a pre-cortical origin. The lateral geniculate body is suggested as a probable seat of Troxler's Effect. (Authors' abstract)

456
Cohen, R. L.
A FURTHER STUDY OF VELOCITY SYNTHESIS. — Scandinavian Jour. Psychol. (Stockholm), 3 (3): 137-142. 1962.

A prediction as to the variation of estimates of subjects performing on the velocity synthesis apparatus, if the intensity of one of the twin spots was to be decreased, was made on the basis of the signal/interference approach. This prediction was then verified by experiment, where it was found that the mean score of a group of subjects estimating absolute velocity was influenced to a far greater extent than that of a group estimating relative velocity, when the intensity of one of the twin spots was decreased stepwise to a level just above the threshold value. (Author's abstract)

457
Craig, E. A.
PROXIMAL FIGURE EFFECTS ON VISUAL ACUITY.—Perceptual and Motor Skills, 16 (2): 385-388. April 1963.

This study was designed to investigate the influence of the presence and orientation of figures proximal to an acuity measurement line. Each of 16 subjects served under four conditions: acuity line alone, acuity line with proximal figures parallel with it, acuity line with 45° proximal figures, and acuity line with 90° proximal figures. All proximal figures tested resulted in decreased efficiency of acuity processes. Orientation of the proximal figure was an important factor with greater influence for 45° and 90° than for the parallel line situation. These results support the Fry-Bartley principle that contour processes interfere with each other and indicate that the influence is directional in character. (Author's summary)

458
Crovitz, H. F.,
and W. Daves
TENDENCIES TO EYE MOVEMENT AND PERCEPTUAL ACCURACY. — Jour. Exper. Psychol., 63 (5): 495-498. May 1962.

The direction of initial postexposure eye movements was studied in a tachistoscopic situation in which a row of numerals appeared across the visual field and no eye movement occurred until the cessation of stimulation. A congruence was found between the direction of the initial eye movement and the side of the visual field more accurately perceived. This finding supports the hypothesis that differential tendencies to eye movement are associated with differential accuracy. A secondary finding was that, in monocular viewing, there were more eye movements to the side of the viewing eye. (Authors' summary)

59
utler, G. H.,
and A. H. Ley
KINETIC VISUAL ACUITY.—Brit. Jour. Physiological Optics (London), 20 (2): 119-127. April-June 1963.

Kinetic visual acuity was investigated with three subjects under monocular and binocular viewing conditions. The results show an initial fall in kinetic visual acuity as compared with static visual acuity at slow target speeds. At increased target speeds this fall is not sustained and the kinetic visual acuity remains fairly constant. At a critical angular rotation of approximately 60° per second there appears a considerable deterioration of kinetic visual acuity. Also the binocular viewing condition appeared to result in a marked improvement of the kinetic visual acuity over the monocular condition.

460
Doesschate, G. ten
VISION IN AN EMPTY VISUAL FIELD.—Aeromedica acta (Soesterberg, The Netherlands), 8: 91-101. 1961-1962. In English.

Under the four experimental conditions used, some young individuals, when looking at an empty visual field, accommodate to a slight degree between 0.25 and 1.75 diopters. Three aged subjects did not accommodate. Some of the younger subjects accommodated in the amount when the whole visual field was empty (more than 180°) and when the extension of the visual field was only 20°. In some cases the same amount of accommodation was found with illuminations of 1.2 and 500 lux. Neither the rectangular frame limiting the visual field employed in one of the experiments nor a simulated illuminated dashboard constituted an adequate stimulus for accommodation. When the empty field is viewed through colored glasses, the color perception gradually disappears and is supplanted by dark grey. In two cases there was a sensation of apparent darkness.

461
Dowling, J. E.
NEURAL AND PHOTOCHEMICAL MECHANISMS OF VISUAL ADAPTATION IN THE RAT.—Jour. General Physiol., 46 (6): 1287-1301. July 1963.

The effects of light adaptation on the increment threshold, rhodopsin content, and dark adaptation were studied in the rat eye over a wide range of intensities. The electroretinogram threshold was used as a measure of eye sensitivity. With adapting intensities greater than 1.5 log units above the absolute ERG threshold, the increment threshold rises linearly with increasing adapting intensity. With 5 minutes of light adaptation, the rhodopsin content of the eye is not measurably reduced until the adapting intensity is greater than 5 log units above the ERG threshold. Dark adaptation is rapid (i.e., completed in 5 to 10 minutes) until the eye is adapted to lights strong enough to bleach a measurable fraction of the rhodopsin. After brighter light adaptations, dark adaptation consists of two parts, an initial rapid phase followed by a slow component. The extent of slow adaptation depends on the fraction of rhodopsin bleached. If all the rhodopsin in the eye is bleached, the slow fall of threshold extends over 5 log units and takes 2 to 3 hours to complete. The fall of ERG threshold during the slow phase of adaptation occurs in parallel with the regeneration of rhodopsin. The slow component of dark adaptation is related to the bleaching and resynthesis of rhodopsin; the fast component of adaptation is considered to be neural adaptation. (Author's abstract) (35 references)

462
Dureman, I.
FACTORS INFLUENCING THE APPARENT VELOCITY OF VISUAL MOVEMENT AFTER-EFFECTS. — Scandinavian Jour. Psychol. (Stockholm), 3 (3): 132-136. 1962.

Estimates of speed of apparent visual movement after-effects (VMAE) were undertaken with induction speed varied in five logarithmic steps from 9° to 144° per second. Two alternative test intervals 0.5 and 1.0 second were used for intermittent inspection of a stationary target. At both inspection intervals VMAE-velocity estimates were found to vary in a systematic way with induction speed. Comparing values from the two test intervals, the 0.5 second interval was found to yield significantly higher speed of VMAE than the 1.0 second interval. (Author's abstract)

463
Eagle, M. N.,
and G. S. Klein
FRAGMENTATION PHENOMENA WITH THE USE OF THE STABILIZED RETINAL IMAGE. — Perceptual and Motor Skills, 15 (3): 579-582. Dec. 1962.

Using the stabilized retinal image technique developed by Pritchard, fragmentation and disappearance phenomena for different visual stimuli were quantitatively studied. It was found that angles are a particularly stable part of the figure more so than lines alone, curved forms are somewhat more stable than jagged forms, and meaningful forms are markedly more stable than meaningless ones. (Authors' summary, modified)

464
Ekman, G.,
and T. Künnapas
BRIGHTNESS OF MONOCHROMATIC LIGHT IN SCOTOPIC AND PHOTOPIC VISION. — Jour. Psychol., 53 (2): 319-327. April 1962.

The main conclusions to be drawn from the present study when compared with certain previous studies are: (1) scotopic as well as photopic brightness of monochromatic light is a power function of intensity of stimulation, (2) the exponent appears to be constant for different wave lengths under both scotopic and photopic conditions, (3) the value of the exponent is approximately the same under both scotopic and photopic conditions, and (4) the constant a of the power function is related both to the absolute thresholds in scotopic as well as photopic vision and to the supraliminal brightness of different wave lengths, intensity of stimulation kept constant. (From the authors' conclusions)

465
Ekman, G.,
and R. Lindman
MEASUREMENT OF THE UNDERLYING PROCESS IN PERCEPTUAL FLUCTUATIONS. — Vision Research, 2 (July-Aug.): 253-260. July-Aug. 1962.

A model is proposed for measuring the variable intensity of a perceptual process at liminal stimulation. The model is based on the assumption of a random variation in addition to a systematic trend. The scaling technique derived from this model is applied to data from an experiment involving liminal scotopic light stimulation. The analysis of data reveals (1) an exponential trend describing the growth of intensity of the perceptual process during the first few seconds of stimulation, and (2) a periodic component responsible for the degree of regularity that exists in the fluctuations. (Authors' abstract)

466
England, S. J. M.,
and B. Pasamanick
THE VISUAL APPEARANCE OF STATIONARY OBJECTS: SOME THEORETICAL PSYCHOPHYSICAL IMPLICATIONS OF THE REAFFERENCE PRINCIPLE. — Jour. Psychol., 55 (1): 63-90. Jan. 1963.

Divergent findings in the area of perception are discussed and integrated considering the principle of reciprocal innervation. Studies reviewed in accordance with the "reafference" principle as set forth by von Holst include experiments with Ganzfeld, binocular "rivalry", stabilized image, fluctuations of accommodation, fluctuations of the pupil width, demonstrations of centrifugal nerve impulses as inhibitors, and demonstrations of the phenomenal stability of visual objects despite eye movements. Many perceptual changes observed in sensory deprivation experiments may also be explained on the same basis. (43 references)

467
Erlick, D. E.
THE ABILITY TO FILTER NOISE FROM A VISUAL TASK WHEN THE NOISE AND SIGNAL ARE PRESENTED SEQUENTIALLY. — Jour. Exper. Psychol., 63 (2): 111-114. Feb. 1962.

The ability of human subjects to filter out visual noise from a task when the signal and noise are presented sequentially was investigated. Two levels of signal intensity and five signal-to-noise ratios (ranging from 1 to 22) plus a no-noise condition were used. A condition using blank time intervals instead of noise at all signal-to-noise ratios was also used. The task involved the judgment of the relative frequency of two random sequential categories (letters A and B presented visually). Ten different letters randomly interspersed among As and Bs represented the noise. There were no significant differences among any of the foregoing conditions, indicating that subjects effectively filtered out the noise when it was presented in sequential relationship to the signal. (Author's summary)

468
Federman, P. J.,
and A. I. Siegel
AIRCRAFT DETECTABILITY AND VISIBILITY. V. DETECTABILITY OF STIMULI COATED WITH FLUORESCENT AND ORDINARY PAINTS, A FURTHER STUDY. — Applied Psychological Services, Wayne, Pa. (Contract N156-38581); issued by Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Problem Assignment no. C12RMA52-16, Part 6). Report no. NAMC-ACEL-470, Feb. 2, 1962. v+41 p.

The detectability of various stimuli was investigated to provide necessary information for increasing aircraft detectability by visual means. The experiments, conducted in a field visual range situation, involved the following stimuli: fluorescent yellow-orange, fluorescent red-orange, fluorescent red-orange with a white medial stripe, ordinary orange (approximating international orange), white, and white with a black medial stripe. The results indicated that the fluorescent yellow-orange stimulus was the most visible under the three meteorological (sky background) conditions involved. The mean threshold data over the three meteorological conditions suggested the following hierarchical order of detectability for the six stimuli: fluorescent yellow-orange, fluorescent red-orange, white, fluorescent red-orange with a white medial stripe, white with a black medial stripe, and ordinary orange. (Authors' abstract)

469
Fiorentini, A.,
and M. Bittini
BINOCULAR INTERACTION EFFECT. II. INVESTIGATION ON THE TIME BEHAVIOUR OF MONOCULAR SENSITIVITY DURING CONTRALATERAL STIMULATION. —— Atti della Fondazione Giorgio Ronchi e contributi dell'Istituto nazionale di ottica (Firenze), 17 (3): 286-301. May-June 1962. In English.

Illumination of one eye has two effects on the sensitivity in a disparate area of the visual field of the other eye, namely, it depresses apparent brightness and impairs sensitivity to time increments of luminance. The time course of both monocular brightness sensitivity and increment sensitivity of one eye was investigated in an interval during which a disparate area of the other eye was suddenly illuminated. A comparison was made with the time course of monocular sensitivity during an interval of time including stimulation of a different area of the same eye. In the case of contralateral stimulation, the apparent brightness of a steadily illuminated monocular field was found to decrease by a smaller amount and with a longer delay than in the case of unilateral stimulation. Comparison between the time course of increased monocular sensitivity during contralateral and unilateral stimulation shows that, even in the latter case, the changes in differential sensitivity induced by presentation of a conditioning field are partly attributable to nonperipheral inhibitory mechanisms. Included are representative figures and graphs. (Authors' summary, modified)

470
Gast, H.,
and K. Arndt
[GLARE SENSITIVITY MEASURED BY MEANS OF THE OPTICAL FLICKER FUSION FREQUENCY]
Die Blendempfindlichkeit, gemessen mit der optischen Flimmerverschmelzungsfrequenz.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (5): 355-363. 1962. In German.

Measurements of visual flicker fusion frequency were undertaken with previously dark-adapted individuals during long-term exposure to intensive glare. The flicker fusion threshold increases significantly over the initial values in all blended observers. Glare-sensitive individuals exhibit immediately upon blending an increase in the flicker fusion frequency threshold. Individuals less sensitive to glare approach their maximal flicker fusion frequency in a stepwise manner. The results are interpreted as pointing toward individual differences in adaptation to light intensity. Longer exposures to glare result probably in a fatigue or satiation effect. It is hypothesized that the glare-sensitive individual becomes fatigued faster than the glare-insensitive individual. The individual tolerance of glare can be easily determined from the flicker fusion frequency curve during exposure to glare. (29 references)

471
Geer, J. P. van de,
and W. J. M. Levelt
DETECTION OF VISUAL PATTERNS DISTURBED BY NOISE: AN EXPLORATORY STUDY.—Quart. Jour. Exper. Psychol. (Cambridge), 15 (3): 192-204. Aug. 1963.

An introductory study of the perception of stochastically specified events is reported. The initial problem was to determine whether the perceiver can split visual input data of this kind into random and determined components. The inability of subjects to do so with the stimulus material used (a filmlike sequence of dot patterns), led to the more general question of how subjects code this kind of visual material. To meet the difficulty of defining the subjects' responses, two experiments were designed. In both, patterns were presented as a rapid sequence of dots on a screen. The patterns were more or less disturbed by "noise", i.e. the dots did not appear exactly at their proper places. In the first experiment the response was a rating on a semantic scale, in the second an identification from among a set of alternative patterns. The results of these experiments give some insight in the coding systems adopted by the subjects. First, noise appears to be detrimental to pattern recognition, especially to patterns with little spread. Second, this shows connections with the factors obtained from analysis of the semantic ratings, e.g. easily disturbed patterns show a large drop in the semantic regularity factor, when only a little noise is added. (Authors' summary)

472
Gibbins, K.,
and C. I. Howarth
THE EFFECT OF INTERMITTENT ILLUMINATION ON THE VISUAL ACUITY THRESHOLD. —— Quart. Jour. Exper. Psychol. (Cambridge), 14 (3): 167-175. Aug. 1962.

An attempt was made to replicate the findings of V. L. Senders that with intermittent illumination short flashes needed less energy than longer ones to make a visual acuity target visible. This apparent breakdown of the reciprocal relation between time and intensity contradicts earlier findings which are in accordance with Bloch's law (the energy required for threshold is constant provided the flash is shorter than a critical duration). The experiments presented here failed to support Senders' results but were in accord with Bloch's law. The authors present a tentative model integrating Bloch's and Talbot's laws enabling predictions about the effect of frequency of repetitive stimulation on thresholds.

473
Glezer, V. D.
Z. N. Ziazina, and L. N. Smolenskaia
[ON CHANGES OF THE FOVEAL RECEPTIVE FIELDS IN MAN] Ob izmeneniiakh foveal'nykh retseptivnykh polei u cheloveka.—Biofizika (Moskva), 7 (4): 486-488. 1962. In Russian.

Test objects of varying sizes were equated in brightness with a comparison field. With an increase in brightness of the comparison field there was a decrease of the full summation zone. The summation coefficients for the test objects with large surfaces also decreased, reaching negative values. It is assumed that with increased illumination of the foveal cone receptor field its summation zone shrinks, with the formation of an inhibitory ring around it.

474
Gregg, L. W.,
and H. W. Karn
PERCEPTUAL RESPONSES AS A FUNCTION OF THE SEQUENTIAL PROPERTIES OF MULTIPLE VISUAL STIMULI. —— Jour. Exper. Psychol., 65 (2): 124-130. Feb. 1963.

Circles located at the points of a triangle were differentially loaded with runs of dots and no dots averaging 2, 4, and 8 in length. Different combinations of loading and location were tachistoscopically presented to three experimental groups with a control group receiving random dot and no-dot combinations at all locations. Experimental groups performed significantly better in terms of error reduction than did the control group. However, variance analysis failed to show an effect of run length, per se. Despite the statistical results, an effect of run length is suggested by an analysis in which straight lines were fitted to the data by the method of least squares. (Authors' abstract)

475
Grunewald, H.
[THE INFLUENCE OF THE AUTONOMIC NERVOUS SYSTEM ON THE DEGREE AND THE DIRECTION OF THE HETEROPHORIAS] Der Einfluss des Vegetativums auf Hohe und Richtung der Heterophorien. —— Albrecht von Graefes Archiv fur Ophthalmologie (Berlin), 165 (2): 130-137. 1962. In German.

The effect of the autonomic nervous system on heterophoria was studied in 60 subjects. Generally, as a result of diurnal fluctuations, there is an increase in esophoria for distance and exophoria for near vision in the evening. This tendency is subject to wide individual variations. After intake of caffeine or luminal there is also an increase of the distance esophoria and near-vision exophoria. The similarity of changes in heterophoria after intake of both drugs is explained on the basis of similarities in the chemical structure of the barbiturates and the central nervous stimulant xanthine component of caffeine.

476
Harcum, E. R.,
and D. W. Dyer
MONOCULAR AND BINOCULAR REPRODUCTION OF BINARY STIMULI APPEARING RIGHT AND LEFT OF FIXATION. —— Amer. Jour. Psychol., 75 (1): 56-65. March 1962.

The purpose of the study was to investigate possible variables affecting the relative accuracy with which observers reproduce complex stimulus-patterns presented in the left and right halves of the visual field. Test-patterns, formed by variously darkening 5 circles in a 10-circle template, were tachistoscopically exposed across fixation. Eye-dominance was simulated for observer by monocular viewing, and hemisphere-dominance was simulated for observer by varying differentially the contrast of the darkened stimulus-elements which appeared in the right or left visual field. The conclusion based on the data of all observers indicates superior accuracy for the left-field elements regardless of viewing eye. For the observers who do not, however, exhibit the general left-superiority, an effect of viewing eye is seen. This effect is consistent with the superior sensitivity of the nasal retina. Left-right field differences are not uniquely related to the handedness of the observers. These data suggest that there is a non-structural and, therefore, presumably learned tendency favoring for most adult observers the elements to the left of fixation in complex patterns such as the ones used in this study. This tendency supersedes all effects of eye or hemisphere dominance, which may be important if the learned left-superiority has not been strongly established. (Authors' summary)

477
Heath, G. G.
THE TIME COURSE OF NIGHT AND SPACE MYOPIA. —— Indiana Univ., Bloomington (Contract AF 33(616)-6142); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6301, Task no. 630103). Technical Documentary Report no. AMRL-TDR-62-80, Aug. 1962. v+39 p.

The refractive state of the human eye was measured over periods up to 4 hours in total darkness and in an empty, lighted visual field, using a subjective optometer, an infrared retinoscope, an infrared automatic recording optometer, and white light and infrared photography of the third Purkinje image. Under both viewing conditions, measurements showed a continuously varying relative myopia produced by accommodative changes, which tended to increase during the first 3-5 minutes and to vary unpredictably thereafter, with continuous, irregular, rapid fluctuations of as much as 0.75 diopter (D.), occasional spontaneous changes of the predominant level by as much as 1 D., and slow drifts of as much as 1.5 D. over periods of several minutes. This highly dynamic accommodative activity in an empty visual field contrasts with previous concepts of a passive and relatively fixed "resting state" of accommodation under such conditions. Factors influencing this accommodative activity were also studied. (Author's abstract)

478
Horsten, G. P. M.,
A. J. Philipszoon, and J. E. Winkelman
INFLUENCE OF DARK ADAPTATION ON CORNEO-RETINAL POTENTIAL DIFFERENCE (C.R.P.) IN

RELATION TO THE ELECTRORETINOGRAM (ERG): A METHOD FOR MEASUREMENT OF THE C.R.P. IN RABBITS.—Ophthalmologica (Basel), 145 (2): 175-184. 1963. In English.

The influence of dark adaptation on the electroretinogram (ERG) and on the corneo-retinal-potential difference (CRP) or resting potential was investigated. A new method for measurement of the CRP in rabbits, in which minimal damage is done to the eye, is described. Dark adaptation was accompanied by a continuous increase of the ERG and continuous decrease of the CRP during a period of one hour. No correlation between the behavior of ERG and CRP during dark adaptation could be found. (Authors' summary)

479
Iarbus, A. L.
[EYE MOVEMENTS DURING PERCEPTION OF MOVING OBJECTS] Dvizheniia glaz pri vospriiatii dvizhushchikhsia ob'ektov.—Biofizika (Moskva), 7 (1): 64-69. 1962. In Russian.

The basic function of the eye movement mechanism is the reduction of the retinal image of a moving object to a state of relative immobility in respect to the retina. The eye movements during perception of a moving object are relatively inconspciuous at a velocity of the object of 1 angular minute per second, but are quite noticeable at velocities exceeding 5 minutes/second. Follow-up eye motions are still possible during an object's velocity of 350-400° per second, however, for a satisfactory perception of a moving object its velocity should not exceed 100-150° per second. While following a moving object, the eye to a certain extent replicates its movement and performs correcting saccadic movements with a delay of 0.1 to 0.2 second. If a moving object disappears suddenly then the eye movement is inhibited for 0.1 second.

480
Iarbus, A. L.
[ON SOME EXPERIMENTS WITH AN IMAGE STATIONARY WITH RESPECT TO THE RETINA] O nekotorykh opytakh s izobrazheniem nepodvizhnym otnositel'no setchatki.—Biofizika (Moskva), 7 (2): 207-210. 1962. In Russian.

Subjects were exposed to an empty visual test field, i.e., a field which is constant and stationary with respect to retina. Changes in illumination of any given segment in the field did not destroy an adjacent empty field, but could change the visible color of the empty field within a very broad range. The visible color of an empty field becomes nondistinguishable from an evenly blinking background, if the frequency of blinking exceeds 3 to 6 periods per second.

481
Iarbus, A. L.
[PERCEPTION OF IMAGES STATIONARY RELATIVE TO THE RETINA AND OF CHANGING COLOR] Vospriiatie izobrazhenii, nepodvizhnykh otnositel'no setchatki i izmeniaiushchikhsia po tsvetu.—Biofizika (Moskva), 7 (3): 333-335. 1962. In Russian.

No differences in a visual test field are perceived during a suprathreshold increase of illumination of an empty field; such an increase is perceived only as an additional light. Any suprathreshold reduction in illumination of an empty field brings about a change in the test field, distorting the visible color of this field. It is known that the threshold of changes of illumination depends on the background. This relationship is retained even when the background is stationary with respect to the retina and is therefore not perceived by the test subject.

482
Jessen, K. H.
[THE ELECTRORETINOGRAM AS AN OBJECTIVE FUNCTION TEST OF THE HUMAN EYE] Das Elektroretinogram als objektive Funktionsprüfung des menschlichen Auges. —Klinische Monatsblätter für Augenheilkunde (Stuttgart), 140 (2): 215-221. March 1962. In German, with English summary (p. 220).

The uses and limitations of the electroretinogram (ERG) as an objective measure of retinal function are discussed. The ERG technique of derivation and stimulation interferes with detection of minor variations. The procedure is useful as an objective functional test of retinal dark adaptation. It is possible also to test the cone system (photopic vision) by this procedure via determination of the spectral sensitivity curve.

483
Karn, H. W.,
L. W. Gregg, and G. F. Pitz
THE EFFECT OF SYSTEMATIC AND NONSYSTEMATIC PRESENTATION OF STIMULI ON PERIPHERAL VISUAL ACUITY. —Jour. Psychol., 53 (2): 491-497. April 1962.

The results of this investigation show an increase in visual acuity with an increase in exposure time, and thus corroborate the findings of previous investigators who have treated the acuity response as a purely retinal event governed by such factors as intensity and duration. In addition, the findings demonstrate a differential effect of exposure time on peripheral visual acuity as a result of a systematic and nonsystematic presentation of the stimuli. Significantly more errors occur under conditions of nonsystematic presentation when exposure times are .1 and .2 second; with exposure times of .5 and 1 second these differences disappear. Apparently, prior knowledge of where the stimulus will appear elicits behavior which enables the subject to improve the accuracy of his perceptual response. Several hypotheses are offered to explain this differential effect of exposure time. (From the authors' discussion and conclusions)

484
Kaswan, J.,
and S. Young
STIMULUS EXPOSURE TIME, BRIGHTNESS, AND SPATIAL FACTORS AS DETERMINANTS OF VISUAL PERCEPTION. —Jour. Exper. Psychol., 65 (2): 113-123. Feb. 1963.

In a forced choice task, five subjects chose between linear displays of dots arranged in pairs or evenly spaced, presented at eight exposure times ranging from .004 to .512 seconds and 8 intensities ranging from .09 to 11.84 millilamberts. Intensity had little effect on accuracy. Accuracy was largely a function of exposure time and, for paired designs, the amount of relative spatial distance between to within pairs of dots. Detecting the presence or absence of stimuli was a joint function of exposure time and intensity and independent of relative spatial distance. The findings support the assumption that perception becomes differentiated over time, and indicate that relative spatial distance can be used as a stimulus measure of differentiation. A two-phase process of the temporal development of perception is proposed. (Authors' abstract)

485
Kawabata, H.
CHANGES IN THE HUMAN ELECTRORETINOGRAM DURING EARLY DARK ADAPTATION.—Jour. Optical Soc. America, 53 (3): 386-390. March 1963.

Measurements were made of the electroretinogram (ERG) to brief stimulus flashes before and during very early dark adaptation, using a contact-lens electrode and a precisely timed light stimulator to investigate this peculiar effect. No significant decrease of the b-wave potential was detected prior to the onset of darkness, but the b-wave showed a rapid increase in response after the cessation of the adapting light. Although the latency of the b-wave to a weak test light was prolonged, it was not long enough to be correlated with the early threshold rise, which occurred as much as 0.2 seconds before darkness. The discrepancy also seems to preclude any suggestion that the threshold rise can be due to inhibition by the negative potential of the off effect. Relationships between x- and b-waves during dark adaptation were also studied. The data emphasize that the human ERG is a dual manifestation of both scotopic and photopic functions of the retina. (From the author's abstract)

486
Kennard, D. W.,
and G. L. Smyth
MINIATURE BLINKS AND THEIR FUNCTIONING IN VISUAL TRACKING [Abstract].—Jour. Physiol. (London), 165 (1): 32P. Jan. 1963.

Movements of the eyelid were recorded with a photo-electric transducer of low operational torque attached to the eyelids. Eye movements were determined simultaneously by means of electro-oculography (EOG). The electromyogram (EMG) of the upper palpebral orbicularis oculi was recorded. The subject fixated a spot of light moving in the vertical plane. With downward tracking, small downward rapid movements of the eyelid were frequently seen. Further evidence derived from the movement of the eye and the action potential of the orbicularis, indicated that these saccadic types of lid movements were due to the activation of the blink mechanism. The records of normal blinks showed the eye to move upwards and the orbicularis muscle to discharge at the beginning of movement. Blinks were also recognized during the course of upward tracking movement. At points where the EOG and EMG indicated blinks to occur, the eyelid record showed a hesitation or possibly a small downward notch. The evidence thus suggested that these were miniature blinks. Blinks appear to interrupt the tracking by the eye. However, a predicting function is probably maintained as tracking is resumed from the point the eye would have reached if no blink had occurred. (Authors' abstract, modified)

487
Khomskaia, E. D.
[ON THE CORTICAL REGULATION OF EYE MOVEMENTS] O korkovoi reguliatsii dvizhenii glaz. — Voprosy psikhologii (Moskva), 9 (3): 64-72. May-June 1963. In Russian, with English summary (p. 72).

Twelve patients with tumor-induced lesions of premotor cortical areas, but with normal convergence and eye movements, were used in the experiments. Eye movements in following a moving target were more or less normal; movements following verbal instructions, however, showed certain irregularities. This demonstrates the existence of a link between the frontal cortical center and some specific forms of eye movement.

488
Kinney, J. A. S.
NIGHT VISION SENSITIVITY DURING PROLONGED RESTRICTION FROM SUNLIGHT.—Jour. Applied Psychol., 47 (1): 65-67. Feb. 1963.

The night vision sensitivity of a group of 24 men was tested monthly during the 3-month submerged cruise of the Triton. There was no evidence in the test scores that night vision sensitivity can be improved beyond its seasonal peak by further restriction from sunlight. (Author's summary)

489
Kinsbourne, M.,
and E. K. Warrington
THE EFFECT OF AN AFTER-COMING RANDOM PATTERN ON THE PERCEPTION OF BRIEF VISUAL STIMULI. — Quart. Jour. Exper. Psychol. (London), 14 (4): 223-234. Nov. 1962.

The perception of briefly exposed visual forms is shown to be masked by an after-coming random pattern stimulus of approximately equal intensity. This effect occurs only under certain well defined conditions; it is limited by the minimum stimulus exposure time in excess of threshold which overcomes masking (critical stimulus duration) as well as by the minimum interval between presentation of the two stimuli which permits evasion of the masking action (critical interval). Over the range of stimulus duration in which masking occurs, critical interval varied with stimulus duration in such a way that the interval multiplied by the stimulus duration equals a constant. Critical stimulus duration and critical interval at threshold are shown to vary little under a variety of conditions. The effect of the random pattern stimulus is limited to the part of the visual field to which it is presented. (Authors' summary)

490
Kinsbourne, M.,
and E. K. Warrington
FURTHER STUDIES ON THE MASKING OF BRIEF VISUAL STIMULI BY A RANDOM PATTERN. — Quart. Jour. Exper. Psychol. (London), 14 (4): 235-245. Nov. 1962.

A brief visual test stimulus may be masked by a preceding random pattern of roughly equal intensity in the same way as by a succeeding random pattern. The parameters of random pattern duration, interval between stimuli, and test stimulus duration limiting the masking effect show a regularity very similar in the two conditions. When the random pattern precedes the test stimulus, the relationship between the two may be stated as follows: Stimulus duration x interval = a constant. The identical effects are found when the two stimuli are presented separately, one to each eye, both for random pattern preceding and succeeding the test stimulus. It is concluded that masking resulted through the same central interaction, whether produced by the preceding or succeeding random pattern. The interaction may be related to, and occur within the limits of, apparent simultaneity of rapidly successive visual stimuli. (Authors' summary)

491
Kolers, P. A.
INTENSITY AND CONTOUR EFFECTS IN VISUAL MASKING. —— Vision Research (Oxford), 2 (Sept.-Oct.): 277-294. 1962.

In previous experiments on the detection of two sequentially presented black stimuli it had been found that the probability of detecting the first of them varied with the temporal interval between them. Two types of relations are discussed: Type A curves, in which threshold duration of a target is found only to increase as the temporal separation (ISI) between the stimuli is shortened; and Type B curves, in which threshold duration of the target increases to a maximum and then decreases as the ISI is shortened. The results indicate: (1) that only Type A curves occur with flashes of light as stimuli to the dark-adapted eye; and (2) when the stimuli are small dark forms (disks and rings) presented to the light-adapted eye, Type B curves describe threshold for the first form when contrast, size, and luminance of the first and second forms are similar and of moderate value. However, when differences exist between the first and second forms on these dimensions in favor of the second, Type A curves describe threshold of the first form. A rate-sampling mechanism is suggested as the basis of the Type A curves with both flashes of light and flashes of low-contrast grey. Some published data on metacontrast are reanalyzed in these terms. A second, auxiliary mechanism seems to be involved with high-contrast black forms. (From the author's abstract) (24 references)

492
Kylstra, P. H.
A PHENOMENON CAUSED BY LIGHTFLASHES IN THE EYE ADAPTED TO DARKNESS. I. —— Nederlandse akademie van wetenschappen, Proceedings, Series C, 65 (1): 66-68. 1962. In English.

Six dark-adapted subjects saw a bright ring surrounding a central fixation light when the eye was illuminated from aside for a short time. The fact that the phenomenon is only seen after a certain period of dark adaptation suggests that the stray light in the eye is perceived by the rods (which are absent in the fovea). The exposure time plays a great part in this phenomenon and may be explained by the difference in the time integration power between periphery and fovea.

493
Kylstra, P. H.
A PHENOMENON CAUSED BY LIGHTFLASHES IN THE EYE ADAPTED TO DARKNESS. II. —— Nederlandse akademie van wetenschappen, Proceedings, Series C, 65 (1): 69-71. 1962. In English.

A method is described with which the angle under which an entoptic phenomenon is seen, can be measured. The ring of light that is seen by the dark adapted eye during short illumination from aside is measured in this way. The inner diameter of this ring is of the magnitude of the fovea, and thus significantly smaller than that of the greatest rod density. (Author's summary)

494
Kylstra, P. H.
A PHENOMENON CAUSED BY LIGHTFLASHES IN THE EYE ADAPTED TO DARKNESS. III. —— Nederlandse akademie van wetenschappen, Proceedings, Series C, 65 (1): 72-74. 1962. In English.

By exposing two subjects to two different sources of light, it was proven that the phenomenon of perceiving a bright ring caused by light-flashes from aside in the dark-adapted eye was not caused by the shadow of the wall of the fovea pit. In the first experiment a flash lamp illuminated the eyes from aside. In the second experiment the light source was a plane of paper diffusely illuminated by a flash lamp which the subject saw via a semitransparent mirror. Both subjects saw the bright ring surround a dark center with either method of illumination. (Author's summary, modified)

495
Latour, P. L.
VISUAL THRESHOLD DURING EYE MOVEMENTS. —— Vision Research, 2 (July-Aug.): 261-262. July-Aug. 1962.

Subjects viewed two alternating lights flashing on in an unpredictable time series, mean time 2.5 seconds, with a delay ranging from 100 to 300 milliseconds. The delayed pulses triggered a white flash, 3 log units above threshold, duration 50 milliseconds, midway between two lights. Thus the faint flash would appear either before, during, or after the eye movement. The subject pushed a button after the eye movement had ceased. The results of plotting the chance of perception of the flash in relation to the time of onset of the eye movement indicate an inhibition developing about 40 msec. before the onset of eye movement. Increased threshold at the end of the eye movement was not observed. The author suggests that it is the "blind mind" which starts the eye movement rather than the proprioceptors which blind the visual system during the eye movement.

496
Liapidevskii, V. K.
[THE CORRELATION BETWEEN THE NUMBER OF RECEPTORS AND THE NUMBER OF INDEPENDENT COLORS] O sviazi mezhdu chislom priemnikov i chislom nezavisimykh tsvetov. —— Doklady Akademii nauk SSSR (Moskva), 146 (3): 696-699. 1962. In Russian.

Models of two photoreceptors with both positive and negative photoconductivity are discussed. Such models correspond to peculiarities of human color vision if the assumption is made that the rods and cones do not sense colors independently and that color vision arises as a result of their simultaneous activity. It is concluded that in man the number of linearly independent colors is not determined by the number of receptors.

497
Lyle, W. M.,
and H. W. Hofstetter
A MODIFICATION OF THE BIO-PHOTOMETER FOR ALTEROCULAR FIXATION CONTROL.—Amer. Jour. Optometry and Arch. Amer. Acad. Optometry, 40 (1): 35-40. Jan. 1963.

A bio-photometer was modified to measure the dark adaptation of one eye while its orientation was controlled by the fixation of the other eye. Preliminary testing over a ten-minute range on a small sample of subjects suggests that relatively good reliability is attainable, and that the test-retest reliability reaches a maximum at about the sixth minute following the end of the bleach period. Reports of the subjects indicate that the visibility judgments are remarkably easier to make by this technique. (Authors' summary)

498
Mackworth, J. F.
THE DURATION OF THE VISUAL IMAGE.—Canad. Jour. Psychol. (Toronto), 17 (1): 62-81. March 1963.

When sets of items are displayed for brief periods, information can be extracted from a visual image which remains after the display has disappeared. Experiments were undertaken to investigate the relation of the amount reported from the visual image to various characteristics of the display. These included the exposure duration, the ratio of the luminance of the display to the luminance between displays, and the number and nature of the items in the display. The study included records of the duration of the response under paced and unpaced conditions. It was found that when the exposure duration was above a critical level it had little effect on the amount reported from the visual image. This critical level depended on the ratio of the display luminance to the luminance between displays, but above this level the luminance had no effect on the amount reported. When the paced response was compared with the unpaced response, the amount reported after exposure was approximately constant, but the duration of the response was not. When the response was unpaced, the duration of the response was constant for simple displays of digits, colors, or letters. The amount reported was proportional to the speed of reporting the different items, and it was concluded that the amount reported was limited by the duration of the visual image. (Author's summary)

499
Mackworth, N. H.,
and I. T. Kaplan
VISUAL ACUITY WHEN EYES ARE PURSUING MOVING TARGETS. —— Science (Washington), 136 (3514): 387-388. May 4, 1962.

The moving target was a small, white rectangle moving horizontally across a large black screen at speeds varying from 0° to 120° of visual angle per second. The stationary acuity object was a design of three parallel white stripes on a black background, and was flashed briefly underneath the moving target. The acuity for the stationary object decreased when following the moving target. This decrease became greater when the target speed increased and when the stripes were in a vertical position. When the object illumination was dim, pursuing the target raised thresholds. A bright stationary object light caused target speed to have little effect.

500
Mercier, A.,
and G. Perdriel
[TRAINING FOR NIGHT VISION] L'entrainement de la vision nocturne. —— In: Visual problems in aviation medicine, p. 84-88. Ed. by A. Mercier. Oxford: Pergamon Press, 1962. In French, with English summary (p. 88).

The morphoscopic night vision threshold (perception of shapes under reduced illumination) appears to constitute the best standard for testing the practical value of an aviator's night vision. This threshold improves with the number of night flight hours. The conditions of night flight were simulated on the ground in order to improve the degree of night vision. The modified Rose and Flack device was systematically used for this purpose according to a technique making it possible to achieve the successive stages of mesopic and scotopic vision and to demonstrate the possibilities and limitations of night vision, and the means to avoid the latter. An improvement of 18% in the morphoscopic vision threshold after eight training sessions was found. This technique permits checking, maintaining, and recovering satisfactory night vision without resorting to the expensive and sometimes dangerous method of frequent night flights.

501
Morris, F. M.
VISUAL ASPECTS OF SPACE FLIGHT. —— Amer. Jour. Optometry, 39 (12): 643-652. Dec. 1962.

In space, due to the absence of atmospheric scatter, a remarkably unique viewing situation will be encountered by the astronaut: the apparent angular size and shape of objects will be influenced by atmospheric interference; the apparent brightness will be independent of the viewing distance; and aerial perspective will be noneffective as a cue to depth perception. Of greater significance to the astronaut will be the uncomfortable viewing situation within the space cabin as instruments not directly illuminated by the sun are in deep shadow. Protection of the eye from possible irreparable damage by the sun (retinal burns) is stressed and the use of high-absorption filters, light-diffusing panels, visors, or, when available, photoreactive goggles or viewing ports may be instrumental in neutralizing the danger. Consideration is briefly given to the effects of the Van Allen radiation belt cosmic radiation, and weightlessness on the eye.

502
Neisser, U.
DECISION-TIME WITHOUT REACTION-TIME: EXPERIMENTS IN VISUAL SCANNING.—Amer. Jour. Psychol. 76 (3): 376-385. Sept. 1963.

The visual scanning method was employed in five experiments to obtain direct measures of the processing time of human information. The results indicate that the method is reliable and permits several tentative conclusions about the organization of cognitive processes in the identification of printed letters. At simple levels, several distinct processes of recognition can function simultaneously in the analysis of a single stimulus-configuration. No such simultaneity appears in the analysis of spatially distinct parts of the input, even after extended practice. The recognitive hierarchy for a given task can be altered to take advantage of different contextual or other conditions. Positive identification of a letter (such as is necessary when a response is contingent on its absence) takes longer than the simple search made when the response is to be contingent on its presence. (Author's summary)

503
Nelson, T. M.,
S. H. Bartley, and R. F. Wise
SIZE DISCRIMINATION UNDER TWO CONDITIONS OF PHOTIC INTERMITTENCY.—Jour. Psychol., 56 (1): 219-225. July 1963.

A series of 17 circular targets were viewed under two conditions of photic intermittency with a pulse-to-cycle fraction of .25. Reproductions of the diameter of the disk were reliably smaller under the 10 c.p.s. condition than under the 48 c.p.s. condition. Two quite different patterns of ongoing neural activity within the channels of the optic pathway are associated with the two conditions of input and these seem related to the perceptual outcome. It is suggested that interruptions of the contour processes brought about the results and that the smaller size resulting under the inhibiting condition occurs because edges form first at the center of the discriminated object and move outward. (Authors' summary)

504
Nikolaev, V. G.,
and Iu. V. Baltaitis
[THE EFFECT OF CHRONIC PAIN ON THE COURSE OF DARK ADAPTATION OF THE VISUAL ANALYZER] Vliianie dlitel'noi boli na khod temnovoi adaptatsii zritel'nogo analizatora.—Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 55 (2): 34-37. Feb. 1963. In Russian, with English summary (p. 37).

A study was made of the effect produced by chronic pain on the course of dark adaptation of the visual analyzor. Sixty persons with pain syndromes of various origin were subjected to examination. Investigation was carried out with the aid of an ADM type adaptometer. The light sensitivity thresholds were expressed in optic density units. Comparison of the data obtained from the results of 36 control experiments demonstrated that in prolonged pain the light sensitivity of the visual analyzor decreased along the whole course of the adaptation curve by 15-18 per cent of the normal value. A rise in light sensitivity, gradually reaching the normal values, was noted after elimination of pain. No deviations from the normal were revealed in cases with periodic transitory sensations of pain. (Authors' abstract, modified)

505
Panian, Z.
[THE INFLUENCE OF DAZZLING ON THE NIGHT VISION IN ROAD AND AIR TRAFFIC] Utjecaj zablještavanja na noćni vid u cestovom i zračnom saobraćaju.—Vojnosanitetski pregled (Beograd), 19 (9): 613-617. Sept. 1962. In Serbo-Croatian.

After a brief review of the basic characteristics of night vision and dark adaptation, the author discusses the subjective and objective consequences of dazzle on retinal adaptation. The effects of dazzle depend on the duration of exposure, the intensity, angle of incidence, and brightness contrast of the dazzling light source. The time of readaptation is subject to wide variation. In experiments on 50 subjects, readaptation occurrend, in general, within 10-61 seconds. Practical applications of these results to road and air traffic are discussed.

506
Pardon, H. R.
A NEW TESTING DEVICE FOR STEREOPSIS. —— Jour. Amer. Optometric Assoc., 33 (7): 510-512. Feb. 1962.

A flashlight test was devised to detect the presence or absence of stereopsis. The results indicate that at five and one-half feet, with a criterion for passing set at four correct answers in four trials, all persons who had normal binocular vision or were able to fuse in spite of occasional squint would pass the test, and all persons who were made monocular or had constant squint would fail the test. (Author's summary)

507
Severin, S. L.,
N. L. Newton, and J. F. Culver
A NEW APPROACH TO THE STUDY OF FLASH BLINDNESS. —— Arch. Ophthalmol., 67 (5): 578-582. May 1962.

A description is given of the Meyer-Schwickerath Zeiss light coagulator for use as an experimental tool in the study of flash blindness. Four subjects were exposed to light flashes of 645 lux to 56,180 lux for a duration of 0.15 second. It was determined that the functional visual loss following dazzle can be measured accurately, and that the coagulator is a reliable instrument. Recovery from dazzle appeared to be consistent and repetitive. Further investigations will be needed to define the recovery function and individual variation.

508
Severin, S. L.,
N. L. Newton, and J. F. Culver
A STUDY OF PHOTOSTRESS AND FLASH BLINDNESS.—School of Aerospace Medicine. Aerospace Medical Division, Brooks Air Force Base, Tex. (Task no. 775101). Technical Documentary Report no. SAM-TDR-62-144, Dec. 1962. iii+6 p.

An experiment was designed to study the effects of pupillary size, flash intensity, testing patch luminance, and subject variability following photostress testing with intense light flashes. Fifteen subjects were esposed to illuminations ranging from 86,080 lux to 242,100 lux as measured at the corneal plane. Recovery was measured as the period of time required after dazzle to regain sufficient visual function to perceive a threshold discriminatory task. Visual discrimination recovery was related linearly to the range of intensities investigated. The results pertinent to aerospace problems are discussed. (Authors' abstract, in part)

509
Shek, M. P.
[INFORMATION LOSS IN THE VISUAL ANALYZER IN RELATION TO THE TYPE OF FATIGUE] Poteri informatsii v zritel'nom analizatore v zavisimosti ot kharaktera utomleniia.—Voprosy psikhologii (Moskva), 9 (1): 111-113. Jan.-Feb. 1963. In Russian, with English summary (p. 113).

Eight test subjects were required to count ruptured and intact rings on a chart while being exposed to fatiguing visual and auditory stimulation. The induced fatigue of either the visual or auditory analyzer led to information loss in the visual analyzer.

510
Smirnov, V. V.,
and I. S. Konobritskii
[CHANGES IN THE EYE REFRACTION AFTER ATROPINIZATION IN FLIGHT SCHOOL CANDIDATES] Izmeneniia refraktsii glaz posle atropinizatsii u kandidatov v letnye uchilishch.—Voenno-meditsinskii zhurnal (Moskva), 1962 (8): 65-66. Aug. 1962. In Russian.

Before atropinization of the eyes of flight school candidates the following data were obtained: 34.4% were emmetropic, 31.0% near-sighted, 23.2% far-sighted, 9.1% astigmatic, and 2.3% anisometropic. After atropinization the corresponding values were 34.2, 22.7, 31.7, 9.1, and 2.3%, respectively. Detailed data are given on the ranges of the refractive aberrations and their changes after atropinization.

511
Smith, Sidney L.
COLOR CODING AND VISUAL RESEARCH. —— Jour. Exper. Psychol., 64 (5): 434-440. Nov. 1962.

Twelve subjects each viewed a series of 300 displays, which varied in display density, in number of colors used, in the particular color of the target, with either a white or black background, under conditions where the subject either knew the color of the target in advance, or did not. Neither the particular color of the target nor the display background had any significant effect on search time. Search time increased regularly with increasing display density. For multicolored displays, when the color of the target was known in advance, search times were considerably shorter than when the target color was unknown. When the color of the target was unknown, search times were not significantly different from those for single-colored displays. (Author's summary)

512
Soussen, G.,
G. Perdriel, and M. Leblanc
[PRELIMINARY STUDY ON THE OCULAR FATIGUE IN RADAR-SCOPE READERS BY DETERMINATION OF THE OBJECTIVE CRITICAL FLICKER FUSION FREQUENCY] Étude préliminaire sur la fatigue oculaire chez les lecteurs de scope-radar par la détermination de la fréquence critique objective de fusion du scintillement. —— Revue de médecine aéronautique (Paris), 1 (4): 52-53. July-Aug. 1962. In French.

The electroretinograms of radar-scope readers after ten hours of work showed a decrease in the intensity of the evoked retinal potential and an increase in the latency time of the B component. Study of the objective critical flicker fusion frequency showed in all cases a negative variation after work. The mean decrease of the threshold was 4.8 flashes/second. This study demonstrates that after a customary hour of this work there exists a total variation of the retinal action potential morphology evoking a discrete injury to the photopic system, and a negative variation, no less total, of the objective critical flicker fusion frequency. These results indicate that this method should be included in a battery of objective fatigue tests applicable not only to personnel charged with ground safety posts but to the problem of fatigue in fliers.

513
Stark, L.,
G. Vossius, and L. R. Young
PREDICTIVE CONTROL OF EYE TRACKING MOVEMENTS. —— IRE Trans. on Human Factors in Electronics, HFE-3 (2): 52-57. Sept. 1962.

A simple instrument for measurement of eye movements has permitted demonstration of the fact that changing the characteristics of the target-position signal has important effects on the nature of the biological servomechanism controlling the movements. In particular, there is an adaptive predictor that allows the system to overcome its innate delays upon exposure to a regular input pattern. (Authors' summary)

514
Strobl, G.,
and P. Follmann
[INTRAOCULAR PRESSURE-TRANSIENTS: DETERMINATION OF THE TRANSIENT FUNCTION ON THE RECUMBENT INDIVIDUAL BY MEANS OF THE APPLANATION TONOMETER] Intraokulare Drucktransiente: Bestimmung der Übergangsfunktion an liegender Versuchsperson mit Applanationstonometer. —— Acta chirurgica Academiae scientiarum hungaricae (Budapest), 3 (4): 415-419. 1962. In German, with English summary (p. 418).

The feed-back regulatory system which governs intraocular pressure is discussed in detail. The temporal course of changes in intraocular pressure evoked by extraocular disturbance up to restabilization is regarded as a transient function. Transients occasioned by postural changes have as the primary determinant a change in the blood pressure. The function in this case can be described qualitatively and is individually determined with regard to its direction. The use of the applanation tonometer helps to avoid the summation of several transients.

515
Trusov, M. S.
[EFFECT OF ESERINE ON LIGHT SENSITIVITY AND DARK ADAPTATION OF THE EYE] Vliianie ezerina na svetovuiu chuvstvitel'nost' i temnovuiu adaptatsiiu organa zreniia.—Oftal'mologicheskii zhurnal (Odessa), 17 (6): 366-371. 1962. In Russian, with English summary (p. 371).

A total of 94 subjects were given subcutaneous injections of a 0.1% aqeous solution of eserine. The doses of 0.5-0.8 ml. caused an increase in light sensitivity and acceleration of dark adaptation in all subjects. The maximal level of light sensitivity was attained 1.5-2.0 hours after injection and was retained for 6-12 hours thereafter. The author recommends the employment of doses 50-60% below standard in order to avoid tonic aftereffects, and concludes that increase in light sensitivity and dark adaptation is probably due to an increase in synaptic acetylcholine.

516
VISUAL PROBLEMS IN AVIATION MEDICINE. — Ed. by A. Mercier. Advisory Group for Aeronautical Research and Development. North Atlantic Treaty Organization. AGARDograph 61. vii+120 p. Oxford: Pergamon Press, 1962.

A series of papers are presented dealing with the ophthalmological problems raised by aviation and the conquest of space. Pertinent papers are abstracted separately, see items no. 500, 520, 905, 906, 940, 979, 1091, 1829, 1836, 2080, 2100, 2115, 2137, 2232.

517
Weale, R. A.
PHOTO-CHEMICAL CHANGES IN THE DARK-ADAPTING HUMAN RETINA. — Vision Research, 2 (Jan.-April): 25-33. Jan.-April 1962.

The method of rapid fundus reflectometry was used in the measurement of pigment recovery in the living human retinal periphery following exhaustive bleaching. Difference spectra measured at various stages of dark-adaptation vary systematically with the latter: this implies that recovery is a complicated process. The half-time of the recovery is approximately 3 minutes and can be influenced by extraneous light. (Author's abstract)

518
White, H.
ON VISUAL ADAPTATION. I. PHOTOCHEMISTRY. — Bull. Mathemat. Biophysics, 24 (4): 351-359. Dec. 1962.

Quantitative aspects of the photochemistry of visual adaptation are considered. A simplified model is given that fits data on changes of rhodopsin concentration during and following strong illumination. A variation on Wald's compartment hypothesis is shown to fit the quasilinear dependence of log threshold upon pigment concentration. Finally, there is a brief review of pertinent data on cone pigments. (Author's summary)

519
White, H.
ON VISUAL ADAPTATION. II. THE ELECTRORETINOGRAM AND THE BIPOLAR CELLS.—Bull. Mathematical Biophysics, 25 (2): 125-139. June 1963.

A model of the b-wave of the electroretinogram is described. The essential part of the model is the diffusion into the rod-bipolar synapse of a transmitter substance, followed by the induction of an inhibitor. Using this model, adaptation to an illumination too weak to cause a significant decrease in the concentration of visual pigment is interpreted as due to a decreased effectiveness of the rod impulse in exciting the bipolar cell. The disparity between threshold changes for very small test spots and for relatively large spots is explained, without invoking any additional physiological mechanisms. (Author's summary, modified)

520
Whiteside, T. C. D.
PROBLEMS OF EMPTY VISUAL FIELDS. — In: Visual problems in aviation medicine, p. 118-120. Ed. by A. Mercier. Oxford: Pergamon Press, 1962.

In an empty visual field there is no visible detail, and the processes of accommodation and fixation cannot function efficiently. To some extent, both accommodation and fixation can take place voluntarily and independently of detail, but the final achievement of optimal focus and of accurate fixation is dependent on the continuous information relating to accommodation and fixational errors which only visible detail can provide. Orientation, which normally depends on the labyrinth and eyes, is modified when the activity of one of these is disturbed by the absence of any point of reference. The use of parallactic displacement is excluded when the background is featureless, and consequently no accurate judgment of distance can be made. The size of an object cannot be judged accurately in the absence of detail in the sky. Many of the near misses reported by aircraft may be due to the problem of empty visual fields confronting aviators.

521
Williams, J. R.,
and R. P. Falzon
COMPARISONS OF SEARCH TIME AND ACCURACY AMONG SELECTED OUTLINED GEOMETRIC SYMBOLS WITH VARIOUS OVERLAYS.—Jour. Eng. Psychol., 2 (3): 112-118. July 1963.

Six subjects were presented with a confusion matrix consisting of 25 symbols of various combinations of outlined squares, circles, triangles, and diamonds with horizontal and vertical lines. The results indicated that certain outlined types, mainly squares and circles, could be combined with slashes, horizontal and vertical lines and be recognized with a high degree of accuracy. Analysis of search time data also indicated that squares and circles ranked highest, and that a high correlation existed between accuracy and search time data. (Authors' summary, modified)

522
Williams, J. R.,
and R. P. Falzon
RELATIONSHIP OF DISPLAY SYSTEM VARIABLES TO SYMBOL RECOGNITION AND SEARCH TIME.—Jour. Eng. Psychol., 2 (3): 97-111. July 1963.

A 2 x 3 x 2 x 3 analysis of variance was designed to analyze the effect of type of matrix, viewing angle, form dimension, and form class on both accuracy and search time. The results indicated that the type of matrix was not significant for search time or accuracy data, although matrix did interact with form dimension for the search time data. Viewing angle was significant for accuracy, but not significant for search time data. Form dimension was significant for search time, but not significant for accuracy data, although it did interact with viewing angle and form class for the accuracy data. Form class, on the other hand, was significant for both the accuracy and search time data. Analysis of the confusion matrix indicated that many symbols were confused with other symbols in the list. Generally the symbols were recognized with a fair degree of accuracy since 53% of the symbols were recognized 80% of the time. The following recommendations are made for the selection of symbols for displays requiring a large number of symbols: (a) simple geometric-area type forms are recommended if high accuracy and low search time is required and the center viewing angle can be used; (b) if right and left viewing angles must be used, and they are not greater than 45%, simple geometric-perimeter type and/or pictorial-perimeter type forms are recommended (the latter type being best); and (c) combined geometric forms, as used in the experiment, are not recommended, since they proved unsatisfactory. (Authors' summary, modified)

523
Wolf, E.,
and B. K. McGowan
THE EFFECT OF LIGHT-TIME: DARK-TIME RATIO AND LUMINANCE ON PERIPHERAL SENSITIVITY TO FLICKER.—Arch. Ophthalmol., 69 (2): 241-250. Feb. 1963.

Measurements of critical flicker frequencies (CFF) were taken along the horizontal meridian from 90° temporal to 90° nasal on 19 points 10° apart with a flicker perimeter utilizing a round flicker target subtending a visual angle of 2° at an object distance of 100 cm. CFF values were highest at the center of the visual field and decreased toward the periphery; the decline in CFF with distance from center was greater in the nasal field than in the temporal field. The highest critical flicker frequencies at each retinal position were obtained with light:dark ratios of 50:50 and 25:75; at shorter and longer light-time fractions, CFF became smaller. Reconstruction of flicker curves from the perimetric data revealed that responses at all retinal locations were brought about by the action of the cones as long as luminance was above 1/1,000 millilambert. At lower target luminance a rise in the flicker response curve was evident, indicating the rod component of the duplex flicker function. Therefore, it seems that as long as target luminance is above the lowest level of luminance for cone excitation, the flicker response is entirely due to cone action, and that the rods enter the perception process only when the test target has a scotopic luminance. (From the authors' summary)

524
Zając, J. L.
SOME INVESTIGATIONS OF PERCEPTION OF MOVEMENT AND RELATED DEPTH PHENOMENA. —Brit. Jour. Psychol. (London), 53 (2): 117-128. May 1962.

Investigations of perception of real movement were carried out using a special apparatus. Movement of a pendular character was produced by placing a prismatic "Chance Crookes" glass in front of one eye of an observer looking through it at a vertical rod, and rotating the glass. Amplitude and direction of the movement were a function of the distance of both the glass and the rod from the eye, of the thickness and prismatic angle of the glass, and of the direction and angle of turn of the glass in relation to the eye. When angle of turn or speed of rotation, or both, were gradually increased, other factors remaining constant, observations concerning movement, in both monocular and binocular vision, varied following fixed sequences for monocular and binocular vision. The experiments consisted in noting the kind of observation and recording the related angle of turn and number of rotations of the prismatic glass; from these data mean speeds of the movement of the image of the rod were calculated. Observations concerning depth phenomena accompanying various kinds of perceived movement were also made. (Author's summary)

c. Hearing

[Ear protectors under 10-b; Hearing tests under 8-f]

525
Abbey, D. S.
CROSS-MODALITY MATCHING OF NUMEROSITY AND PITCH.—Canad. Jour. Psychol., 16 (4): 283-290. Dec. 1962. (DRMLR no. 242-2.)

Four groups of five male subjects were employed to obtain magnitude estimates of numerostiy (dots) and of pitch (frequency), and to match numerosity to pitch and pitch to numerosity. An equivalent sensation function derived from the magnitude estimates was found to predict the experimental cross-modality matches with reasonable accuracy. It is argued that the method described has greater flexibility and is easier to employ than the usual procedures used by S. S. Stevens et al., in similar types of studies. (Author's summary)

526
Alekseenko, N. IU.
[THE DYNAMICS OF CHANGE OF SPATIAL SOUND PERCEPTION INDUCED BY PROPRIOCEPTIVE STIMULATION] Dinamika izmenenii prostranstvennogo vospriiatia zvuka pod vliianiem propriotseptivnykh razdrazhenii.—Doklady Akademii nauk SSSR (Moskva), 148 (5): 1218-1220. 1963. In Russian.

The influence of head turns on the binaural localization of sound stimuli was studied on seven subjects in 200 experiments. In 139 instances the turns of the head resulted in a displacement of the auditory image away from the median line. In 59 cases the displacement was inhibited for 12 to 60 sec.; during the first signals emitted after the head turn the auditory image remained on the median line, and only during subsequent signals it was displaced. It is probable that spatial sound perception, apart from the binaural effect, is governed by other interrelated factors.

527
Avakian, R. V.,
and E. A. Radionova
[SPECIAL FEATURES OF INTENSITY DISCRIMINATION THRESHOLDS FOR A SHORT SOUND SIGNAL] Osobennosti differentsial'nykh porogov po intensivnosti dlia korotkogo zvukovogo signala.—Akusticheskii zhurnal (Moskva), 8 (4): 407-411. 1962. In Russian.

Intensity discrimination thresholds, 10 to 90 db. above the auditory threshold, were determined on two test subjects. The curve of intensity discrimination thresholds for short sound signals differs significantly from those of the longer sound signals by having a "hump" in its middle section. In the 40-70 db. range, the discrimination threshold for short signals is from 1.3 to 1.9 db. higher than at either lower or higher intensities. It is assumed that this phenomenon is connected with the existence of two groups of elements, differing in threshold ranges, located in the peripheral part of the auditory analyzer, and that the intensity of short sound signals is being measured by the number of synchronically corresponding elements.

528
Babkoff, H.,
and S. Sutton
PERCEPTION OF TEMPORAL ORDER AND LOUDNESS JUDGMENTS FOR DICHOTIC CLICKS.—Jour. Acoust. Soc. Amer., 35 (4): 574-577. April 1963.

The effect of a loudness cue on the perception of the temporal order of dichotically presented clicks was investigated in three subjects. It was shown that one can find a range of temporal intervals between dichotically presented clicks for which increasing temporal separation results in a decrease in the correct judgment of temporal order. (Authors' abstract)

529
Békésy, G. von
THREE EXPERIMENTS CONCERNED WITH PITCH PERCEPTION.—Jour. Acoust. Soc. Amer., 35 (4): 602-606. April 1963.

Three experiments indicate that the place of the excitation along the basilar membrane determines pitch perception. Without changing the periodicity of a tone, its pitch can be raised or lowered by masking. The changes in the size of a sound image produced by masking can be explained in terms of the place theory of hearing. Pitch sensations seem to be connected in an orderly way to place of excitation along the basilar membrane, since it is possible to observe the time differences required by the traveling waves to reach the different places along the membrane. (Author's abstract)

530
Bocca, E.,
and G. P. Teatini
AUDITORY RECOVERY TIME AFTER SHORT SOUND STIMULATIONS: AN EXPERIMENTAL CONTRIBUTION. — Jour. Auditory Research, 2 (3): 187-193. July 1962.

Hearing recovery time was studied in four subjects by measuring the duration of interruption required for discontinuous white noise to exert a masking effect on a test tone equal to the effect of continuous noise. The research was conducted at various intensity levels for both the noise and the test tone. Recovery time was found: (1) to be 25 milliseconds for all four subjects, with very few fluctuations, when the S/N ratio was kept constant at the minimum masking level; (2) to be independent of the test-tone frequency; (3) to be independent of the test-tone intensity, S/N ratio being equal; (4) to increase in geometrical proportion with increases in intensity of the masking noise if the test-tone intensity level was kept constant; and (5) to be independent of the duration of the masking noise for noise bursts and silent intervals no longer than 2000 msec. (Authors' summary and conclusions, modified)

531
Bragg, V. C.
CUMULATIVE EFFECTS OF REPEATED EXPOSURE TO HIGH-INTENSITY TONES UPON RECOVERY OF AUDITORY SENSITIVITY.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-2005, Subtask 3). Report no. 1, Aug. 4, 1963. ii+13 p.

Twenty subjects with normal hearing were subjected to four series of twenty exposures of a 3000 c.p.s. tone. Each series of exposure tones was presented at one of four sound-pressure levels: 85 db., 90 db., 95 db., or 100 db. above 0.0002 microbar. The time required for threshold for a 4500 c.p.s. pulsed tone to recover to within 20 db. and 10 db. of pre-exposure level was measured after each one-minute exposure. The pattern of recovery times indicated that (a) there is a critical intensity (95 db. in the present conditions) below which adaptation is evoked and above which cumulative fatigue results from exposure, and (b) cumulative fatigue holds more promise than adaptation in the development of a noise-susceptibility test. (Author's abstract)

532
Broadbent, D. E.
ATTENTION AND THE PERCEPTION OF SPEECH. — Scient. American, 206 (4): 143-148, 151. April 1962.

A discussion is presented of the reception and interpretation of two voice messages heard at the same time. Spatial separation of the voices, their physical characteristics, and the number of signals are discussed as to reaction time and comprehension. An attention mechanism for selecting the desired information is suggested. Past experiments indicate that a person can listen to one man and ignore another by merely selecting the frequencies of the various sounds that are modulated at the same rate. The brain then possibly differentiates those nerve fibers transmitting at the same rate. Modulation may then be one of the basic characteristics of the selection mechanism along with selection on the basis of content.

533
Bryden M. P.
ORDER OF REPORT IN DICHOTIC LISTENING. —Canad. Jour. Psychol., 16 (4): 291-299. Dec. 1962. (Defence Research Board of Canada Grant no. 9401-11)

Two experiments in which subjects heard two different digit sequences at the same time were carried out. In the first experiment, the material was presented dichotically, one series to each ear. Series of 3, 4, or 5 pairs of numbers were presented at rates of 1 pair/half-second, 1 pair/sec., and 1 pair/2 sec. At rapid rates of presentation, subjects tended to report the numbers from one ear followed by the numbers from the other ear. As the rate slowed, the frequency and accuracy of this order of report decreased, while the frequency and accuracy of reporting the material in the order it arrived at the ears increased. Changes in the amount of material presented increased the number of errors, but did not systematically alter the order of report. A second experiment showed that confusion between the two channels increased when separation of the two channels was made more difficult by presenting the material through spatially separated speakers. The results seem to indicate that the ear order of report is a natural one requiring only a mechanism for the simple recall of sequences plus some means of keeping the channels separate. On the other hand, an active reorganization through rehearsal takes place at slow rates of presentation. (Author's summary)

534
Bryden, M. P.
EAR PREFERENCE IN AUDITORY PERCEPTION. — Jour. Exper. Psychol., 65 (1): 103-105. Jan. 1963.

In a dichotic listening experiment, normal adult subjects identified numbers presented to the right ear more accurately than numbers presented to the left ear and preferred to report the material from the right ear first. To evaluate the effect of order of report, a further experiment was performed with 32 subjects, in which they were instructed to report each channel first equally often. When 3 or 4 digits were presented to each ear, most subjects identified material from the right ear more accurately than material from the left ear. When 5 digits were presented to each ear, this difference was not observed. The findings suggest that the auditory system is better organized for the perception of verbal material presented to the right ear. (Author's summary)

535
Brzezinski, D. K. von
[MICROSTRUCTURE, MUSCLE SPINDLES, AND THE FUNCTION OF THE MIDDLE EAR MUSCLES OF MAN] Feinbau, Muskelspindeln und Funktion der Mittelohrmuskeln des Menschen.—Archiv für Ohren- Nasen- und Kehlkopfheilkunde (Berlin), 179 (6): 550-566. 1962. In German, with English summary (p. 565).

A detailed description is presented of the microstructure of the muscles of the auditory ossicles in man. Of note is the finding that the tensor tympani muscle is composed of typical muscle spindles but the stapedius muscle is not. This phenomenon is interpreted in the light of the anatomical and functional relations between the ossicles and their muscles. Various theories about the function of these muscles are discussed and revised. The tympanic membrane, the ossicles, and the auditory muscles are considered as a regulation system actively directed by the muscle spindles of the tensor muscle. Besides sound conduction and amplification this system has also a protective damping function for the inner ear and itself. The main effector of the protective function is the stapedius muscle; the tensor muscle acts as a receptor. (From the author's summary)

536
Byers, V. W.
TWO METHODS OF MEASURING RECOVERY FOLLOWING SHORT-DURATION FATIGUE.—Jour. Acoust. Soc. Amer., 35 (5): 662-671. May 1963.

Eight subjects participated in an investigation to determine if a difference exists between the method of continuous tone threshold tracing and periods of silence in measuring recovery one-half octave above a 3-minute, 90-decibel, 4000 c.p.s. exposure. Previous research reported two types of recovery following high-level exposure. One, R-1, is the rapid recovery occurring during the first minute after cessation of the exposure. The second, R-2, is a slower, more stable recovery occurring in the second and following minutes of recovery. The study was divided into experiments that compared the effects of silence and continuous tone trace at various time intervals after cessation of exposure. Comparison times varied up to 6 minutes and included both types of recovery, R-1 recovery ignoring R-2, and R-2 recovery ignoring R-1. The major findings were: (1) the method of continuous tone trace to measure recovery resulted in an overlaid fatigue on the level of the fatigued threshold. Continuous tone threshold tracing after high-level exposure were considered a fatiguing exposure, but on a magnitude comparable to low-level exposure; (2) immediately following cessation of the exposure, the introduction of silence rather than continuous tone trace resulted in faster recovery; and (3) an accumulative effect that modified the pattern of recovery was observed following repeated high-level exposures. This effect was in the direction of no change in the level of the fatigued threshold from the second to sixth minute of recovery. (From the author's summary and conclusions)

537
Campbell, R. A.
FREQUENCY DISCRIMINATION OF PULSED TONES. —Jour. Acoust. Soc. America, 35 (8): 1193-1200. Aug. 1963.

If a 2200-c.p.s. tone is pulsed 150 times per second under appropriate conditions, a low pitch (periodicity pitch) is heard corresponding to that of a 150-c.p.s. tone although there is little or no energy present at 150 c.p.s. in the signal. Absolute threshold measures were obtained for three stimuli: a 2200-c.p.s. sinusoid, a 150-c.p.s. sinusoid, and a 2200-c.p.s. tone pulsed 150 times/sec. Frequency discrimination measures were obtained for the same three stimuli at various sensation levels. The measures obtained for the pulses were compared, by analysis of variance and correlation techniques, to those measures for each of the sinusoids. The cochlear detection hypothesis would demand a close relation between the pulse and 150-c.p.s. measures although none was found. Conversely, the central detection hypothesis would demand a closer relation between the pulse and 2200-c.p.s. measures, which was found. Furthermore, a lack of monotonic relation between perceived pitch and repetition rate and a large "atonal range" was found for the pulses, indicating their perception involved mechanisms not involved in the perception of the sinusoidal stimuli, i.e., a central temporal analysis. (From the author's abstract)

538
Coleman, P. D.
AN ANALYSIS OF CUES TO AUDITORY DEPTH PERCEPTION IN FREE SPACE.—Psychol. Bull., 60 (3): 302-315. May 1963.

Physical acoustics reveals a number of stimulus correlates of sound source distance. Quantitative estimates of these stimulus correlates are compared with appropriate psychophysical thresholds. Such comparisons show that most of these stimulus correlates can, with various restrictions, provide distance information detectable by the ear(s). The stimulus correlates dealt with at greatest length are: intensity, frequency spectrum at near and far distances, binaural intensity ratio, and interaural phase (or time) differences. Problems relating to the use of some of these stimulus correlates as cues are discussed. Other possible distance cues are briefly mentioned. The possible use of much of the available physical information in making distance judgments has not yet been adequately evaluated in psychophysical studies. (Author's abstract) (51 references)

539
Corson, J. F.,
and M. Levine
PITCH DISCRIMINATION BY AIR CONDUCTION AND BY BONE CONDUCTION FOR SONIC AND ULTRASONIC FREQUENCIES [Abstract].—Jour. Acoust. Soc. America, 35 (5): 804. May 1963.

Five groups of five subjects each, screened for normal hearing and high-pitch ability, were tested in an anechoic chamber from 2 to 54 kilocycles/second at a loudness level of 20 phons by the method of constant stimuli. The results indicated that (1) from approximately 4 to 14 kc./sec., the difference limens for pitch discrimination by bone conduction were smaller than those for air conduction, and (2) pitch discrimination was absent for bone-conducted tones in the ultrasonic region. The difference limens for bone conduction varied from a minimal value of 7 cycles at 2 kc./sec. to 134 cycles at 14 kc./sec.; for air conduction, the difference limens varied from a minimal value of 7 cycles at 2 kc/sec. to 148 cycles at 14 kc./sec. (From the author's abstract)

540
Creelman, C. D.
LOUDNESS MATCHING, DETECTION, AND DISCRIMINATION OF BAND-LIMITED SHORT TONES [Abstract].—Jour. Acoust. Soc: America, 35 (5): 777. May 1963.

With a method of adjustment procedure, observers equated gated 1000-c.p.s. sinewave signals, one of which was passed, after gating, through a narrow-band filter. Filtered signals were found to be less loud than unfiltered signals of the same duration. This effect depends on the duration of the signals; at 2 milliseconds, filtered signals are roughly 6 decibels below unfiltered signals in loudness. The loudness discrepancy disappears at durations greater than 50 milliseconds. Signal-detection and amplitude-discrimination measures were made separately for filtered and unfiltered signals of 5-milliseconds duration. Amplitude discrimination seems to be superior for unfiltered signals as compared to filtered signals, although the discrepancy is small and hardly sufficient to account for the loudness differences obtained. (Author's abstract)

541
Creelman, C. D.
DETECTION, DISCRIMINATION, AND THE LOUDNESS OF SHORT TONES.—Jour. Acoust. Soc. America, 35 (8): 1201-1205. Aug. 1963.

Two experiments were conducted, with the same observers in each. A method of adjustment was first used to measure the relative loudness of short tonal signals at four different durations and four intensity levels. The second experiment measured the detectability of each duration which has been used in the first, and scales were constructed on the basis of the measurements. It was shown that the relative loudness of a short tone (the level to which it will be set to sound equally loud) can be predicted from the detectability scale. The relationship is an extremely simple one: the equal-loudness settings yield signals of equal detectability. (Author's abstract)

542
Dallos, P. J.,
and R. Carhart
CUMULATION OF DL'S FOR INTENSITY CHANGE AT LOW SENSATION LEVELS.—Jour. Acoustical Soc. Amer., 35 (6): 848-855. June 1963.

Data which appear in the literature on normal difference limen (DL) for intensity change lead to the hypothesis that, for pure tones through a sensation level of 40 decibels, a linear function relates 1/jnd (just noticeable difference) to the sensation level. A nonlinear difference equation expressing this hypothesis is developed here. A resultant formula allows the number of jnd's which cumulate within a range of sensation levels to be compared, provided one knows the DL magnitudes at the two limits of that range. The adequacy of this procedure was tested on six normal hearers. It was found that the number of jnd's which each subject exhibited when DL's were successively cumulated experimentally at 1000 and 4000 c.p.s. corresponded to within an average error of 4.0% to the number predicted from the formula. The maximum single error of prediction was 6.6% (Authors' abstract)

543
Durlach, N. I.
EQUALIZATION AND CANCELLATION THEORY OF BINAURAL MASKING-LEVEL DIFFERENCES.—Jour. Acoust. Soc. America, 35 (8): 1206-1218. Aug. 1963.

A quantitative "black-box" model is developed for use in interpreting certain data on binaural-masking-level differences. The basic idea of this model is that the auditory system attempts to eliminate the masking components by first transforming the stimuli presented to the two ears so as to equalize the two masking components, and then subtracting. In order to obtain results that are quantitatively realistic, this processing is assumed to be corrupted by various types of errors. The model is applied to data in which the signal to be detected consists of a pulsed tone, the masking signal consists of loud, broad-band, Gaussian noise, and the only differences between the stimuli presented to the two ears are those of time delay or amplitude (the interaural amplitude ratios being restricted to unity or zero). The results indicate that the ability of the auditory system to control interaural intensity ratios and interaural time delays is limited to accuracies of about 1 decibel and 150 microseconds and that the auditory system has difficulty in compensating for interaural time delays greater than the time it takes for sound to travel a distance equal to the width of the head. (Author's abstract) (31 references)

544
Elliott, D. N.,
W. Riach, and H. R. Silbiger
EFFECTS OF AUDITORY FATIGUE UPON INTENSITY DISCRIMINATION. —— Jour. Acoust. Soc. Amer., 34 (2): 212-217. Feb. 1962.

Auditory intensity discrimination thresholds (IDT) as well as thresholds of audibility were determined. Significant decreases in the IDT were found to follow fatiguing exposure, such changes being related in a negatively decelerated manner to the threshold of audibility. The extent of the changes in IDT as a function of fatigue was found to be inversely related to the sound pressure level of the signal to be discriminated. As a result of these two relationships the range of IDT's as a function of signal strength was markedly decreased for the fatigued ear. In addition, no relationship was found between normal IDT's and size of the recording pen excursions bracketing the threshold of audibility, or in the change in the size of these two measures as a function of fatigue. (From the authors' abstract)

545
Elliott, L. L.
PREDICTION OF SPEECH DISCRIMINATION SCORES FROM OTHER TEST INFORMATION.— School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775503). Technical Documentary Report no. SAM-TDR-62-145, Dec. 1962. iii+13 p.

The prediction of speech discrimination (PB) scores by using other audiometric test information was attempted. For two samples tested with Rush Hughes (RH) materials and one sample tested with W-22 materials, PB score in the nontest ear and difference between speech reception thresholds in the test and nontest ears were the two best predictors of PB scores. The RH estimating equation developed on these samples was applied to groups with normal hearing (very poor prediction) and mixed losses (moderately good prediction). Application of the equations to cross-validation samples indicated high validity cofficients for the W-22 equation, but only moderate validity coefficients for the RH equation. Results suggest that the predictive contribution of PB score in the nontest ear includes the effect on nonmeasured variables such as subject's verbal aptitude, motivation, difference between speaker's and listener's dialects, etc. (Author's abstract)

546
Elliott, L. L.
TONAL THRESHOLDS FOR SHORT-DURATION STIMULI AS RELATED TO SUBJECT HEARING LEVEL.—Jour. Acoust. Soc. Amer., 35 (4): 578-580. April 1963.

The loudness threshold for pure tones (500, 1000, and 4000 c.p.s.) varying in duration from 3 to 1000 milliseconds was studied among subjects with hearing levels ranging from normal to severe sensorineural loss. Results showed a negative relationship between slope of the short-duration/threshold function and hearing acuity. (Author's abstract)

547
Fletcher, J. L.
REFLEX RESPONSE OF MIDDLE-EAR MUSCLES: PROTECTION OF THE EAR FROM NOISE.—Sound, 1 (2): 17-23. March-April 1962.

A series of experiments on the protection of military personnel against impulse and steady-state noises by activation of the acoustic reflex contraction (tensor tympani and stapedius muscles) is described. The experiments are based on the bilateral nature of the middle ear reflex. The hearing thresholds of 24 subjects were measured with a Békésy audiometer after a session of reflex-activating tone plus gunfire or gunfire alone. Natural stimulation by acoustic means produced sufficient reflex tension in the intra-aural muscles to attenuate sounds impinging on the ear. Thirteen subjects were tested after a similar set of experiments using no protection, or protection from either acoustic reflex or V-51 R earplug. Data obtained showed that the acoustic reflex provided more protection up to and including 1000 c.p.s. than the earplug, but protection at and above 2000 c.p.s. was greater for the earplug. No discernible protective effects against continuous noise were obtained by using pure-tone stimuli; but in an experiment comparing the effects of pure tone, square wave, and narrow- and broad-band noises, narrow-band noises were the most effective in maintaining the middle ear reflex for a prolonged time. Click stimulation also induced a temporary threshold shift in the ear and provided a certain amount of protection.

548
Frey, A. H.
HUMAN AUDITORY SYSTEM RESPONSE TO MODULATED ELECTROMAGNETIC ENERGY. —— Jour. Applied Physiol., 17 (4): 689-692. July 1962.

Using extremely low average power densities of electromagnetic energy, the perception of sounds was induced in normal and deaf humans. The effect was induced several hundred feet from the antenna the instant the transmitter was turned on, and is a function of carrier frequency and modulation. Attempts were made to match the sounds induced by electromagnetic energy and acoustic energy. The closest match occurred when the acoustic amplifier was driven by the radio-frequency transmitter's modulator. Peak power density is a critical factor and, with acoustic noise of approximately 80 db., a peak power density of approximately 275 mw./cm.^{2} is needed to induce the perception at carrier frequencies of 425 mc. and 1,310 mc. The average power density can be at least as low as 400 μw./cm.^{2}. The evidence for the various possible sites of the electromagnetic energy sensor are discussed and locations peripheral to the cochlea are ruled out. (Author's abstract)

549
Gerall, A. A.,
and C. Snyder
NON-SPECIFIC MUSCULAR TENSION AND AUDITORY THRESHOLD. — Perceptual and Motor Skills, 14 (2): 179-182. April 1962.

The effect on the auditory threshold of a 1000-c.p.s. tone of non-functionally related muscular exertion was tested with 16 subjects who pulled 0-, 100-, 200-, 300-, 400-, 800-, and 1600-gram weights. A second group of six subjects pulled only 0, 100, or 1600 grams consecutively in each series to control for possible interaction of weights intermixed in the main experiment. No significant differences in the auditory threshold, as determined by a method of constant stimuli, due to weight pulling were found. The results were interpreted as agreeing with previous work suggesting that muscular activity having no functional or "geographical" relationship to a sensory process would not influence its threshold. The hypothesis of vicarious channelization was not supported by the data. (Authors' summary)

550
Gol'dburt, S. N.
[PECULIARITIES OF FORCE-DURATION CURVES OF THE STIMULATED AUDITORY ANALYZER IN MAN DURING THE AFTEREFFECT OF TONAL STIMULATION (AGAINST A BACKGROUND OF RESIDUAL MASKING)] Svoeobrazie krivykh silydlitel'nosti vozbuzhdennogo slukhovogo analizatora cheloveka v usloviiakh posledeistviia tonal'nogo razdrazheniia (na fone tak nazyvaemoi ostatochnoi maskirovki).—Biofizika (Moskva), 7 (3): 336-344. 1962. In Russian.

Two subjects with normal and one with impaired hearing served as subjects. They were first exposed to a tone of 1000 c.p.s., 500 milli-seconds duration, and 100 decibels intensity, then the threshold value for a second tone of the same frequency and 4.4, 44, and 160 msec. duration was measured at certain intervals. The sound pairs were emitted in a rhythmic series of one sound per 6 seconds. The thresholds were measured 0.6, 3.0, 7.6, 36, 86, 170, 360, 480, and 1000 msec. after the termination of the first tone. The resulting force-duration curves are analyzed. (26 references)

551
Green, D. M.
CONSISTENCY OF AUDITORY-DETECTION JUDGMENTS [Abstract].—Jour. Acoust. Soc. America, 35 (5): 788. May 1963.

The audio information presented during a sequence of two-alternative forced-choice trials was taped and repeated to the observer at a later time. The consistency of the observer's judgments was measured by determining a percent agreement score: the percent of times the subject agreed with his previous response on those special trials of the sequence in which no signal occurred on either interval of the forced-choice trial. Percent agreements range between 80% and 55%, depending on the observer and, perhaps, on the signal occurring on the signal trials. A simple linear model was used to establish a lower bound on the ratio of internal to external noise. Unlike some previous experiments, little evidence could be found for large response dependencies in this type of task. That the observer could occasionally hear the signal probably explains why his behavior remained, to a large degree, under stimulus control. (From the author's abstract)

552
Harbert, F.,
and I. M. Young
THRESHOLD AUDITORY ADAPTATION. — Jour. Auditory Research, 2 (3): 229-246. July 1962.

Pathological rapid threshold adaptation is manifested by reduced amplitude of steady-tone tracings and may indicate a lesion primarily involving dendrites or telodendria. Wide separation between pulsed and steady tracings, and threshold drift, indicate pathologic slow adaptation. This may be due to widespread partial damage to axons. Cases showing wide separation usually also show significant tone decay, fixed frequency threshold drift, and very poor discrimination. The amount of pathological adaptation as measured by the Békésy threshold level is inversely proportional to the off-time for interrupted stimuli but this is not a simple function. Changing the on-time has a significant effect only when the on-time is very short (about 15 msec. or less). Abnormal adaptation is proportional to the intensity at which the tone is first presented and may spread from adjacently stimulated areas. (Authors' summary)

553
Harris, G. G.,
J. L. Flanagan, and B. J. Watson
BINAURAL INTERACTION OF A CLICK WITH A CLICK PAIR.—Journal of the Acoustical Society of America, 35 (5): 672-678. May 1963.

The binaural interaction between a single click and a click pair was examined. Two clicks with time separations of 0.5, 1, 2, 4, and 8 milliseconds (msec.) were presented to one ear, and a single click of controllable interaural time was presented to the other. Two polarity patterns (rarefaction-rarefaction vs. rarefaction; and rarefaction-condensation vs. rarefaction) were used at pattern rates of 2, 10, and 50/second. Four subjects were asked to adjust interaural time to center all discernible sound images. Lateralization corresponding to temporal alignment with individual clicks in the pair were found for 8-msec. and sometimes for 4-msec. separation. For these conditions, the subjects were consciously aware of two images. With 1-msec. separation of the pair, subjects were aware of only one image, but in repeated adjustments temporally aligned at both clicks. With 2-msec.

separation, however, no significant lateralizations were made at the time of the second click. Only one image was discernible corresponding to lateralization of the first click. Analog basilar-membrane displacements produced by the stimuli correlated with some details of the results, but did not explain the absence of a second lateralization at the 2-msec. pair separation. The neural mechanisms usually invoked to explain a minimum time interval of about 3 msec. were also not adequate to explain these results. (From the authors' abstract)

554
Harris, G. G.
PERIODICITY PERCEPTION BY USING GATED NOISE.—Jour. Acoust. Soc. America, 35 (8): 1229-1233. Aug. 1963.

Gated white noise was used as a stimulus in a psychophysical experiment to determine the temporal resolution of the ear. Although exhibiting temporal periodicity of the envelope, gated white noise has a uniform power spectrum that possesses no information for a place mechanism of the ear. Four subjects varied the gating frequency to match this stimulus to a 0.1-msec click whose repetition frequency was set by the experimenter. All stimuli were 40 decibels SL. Ungated noise was added to the gated noise to mask any switching transients. Fraction of time noise was gated on and filter conditions were set by the experimenter. For an on-time fraction of 0.2 and 0.5, time information in the gated noise (all-pass and 2400 c.p.s. high-pass) could be utilized to match to a click frequency up to 750 c.p.s. With 4800-c.p.s. high-pass gated noise, a weak timing signal was probably perceived up to 2000 c.p.s. In a second part of the experiment, subjects attempted to lateralize gated, binaurally incoherent noise. A lateralized image could be formed up to a frequency of about 600 c.p.s. The timing signal present in gated noise is not necessarily related to the percept of pitch, especially for high-pass stimuli. (Author's abstract)

555
Harris, J. D.,
and A. G. Pikler
COMPENSATORY AND PURSUIT TRACKING OF PITCH.—Jour. Acoust. Soc. Amer., 35 (4): 581-587. April 1963.

The present experiment explores, in a preliminary way, compensatory and pursuit frequency tracking of 250 c.p.s., and of the musical interval middle C-middle E; delineates the individual differences among subjects; explores the effect of possession of absolute pitch; explores the effect of change in speed in the program over a range of 1.25 through 5 c.p.s./second; and indicates its possible usefulness in human engineering. (Authors' abstract, modified)

556
Hedgecock, L. D.
THE EFFECTS OF NOISE ON HEARING. —— Postgraduate Med., 31 (6): 584-587. June 1962.

Extensive data indicate that the loss of hearing acuity observed with increasing age may be attributed to presbycusis or to the effects of exposure to noise. The problem of differentiating between these two causes of hearing loss is complicated by the many variables in exposure and susceptibility to noise. In this discussion, the author reviews methods for measuring noise and detecting susceptibility to noise, the types of acoustic trauma, and criteria for judging noxious noise. With the establishment of programs for conserving hearing, the relative effects of noise and age on hearing should be better understood. (Author's abstract)

557
Kryter, K. D.,
A. Z. Weisz, and F. M. Wiener
AUDITORY FATIGUE FROM AUDIO ANALGESIA. —— Jour. Acoust. Soc. Amer., 34 (4): 383-391. April 1962.

The fatiguing effects of intense noise and music as well as an explanation for the basis for a damage-risk criterion are studied. Subjects were measured for temporary threshold shifts at pure tones of 100-10,000 c.p.s. Average hearing loss at 4000 c.p.s. was 23 decibels. Music produced losses of 21-23 decibels at 4000-6000 c.p.s., and maximum fatigue was observed at 5000 c.p.s. Temporary threshold shift was considerably lower at 2000 c.p.s. It appears that exposure to a sound in the average person who suffers a temporary threshold shift of 20 decibels or less at any frequency is a "safe" exposure.

558
Loeb, M.,
and J. L. Fletcher
SUSCEPTIBILITY TO TEMPORARY THRESHOLD SHIFT AS A FUNCTION OF AGE AND SEX [Abstract].—Jour. Acoust. Soc. America, 35 (5): 782. May 1963.

Fifty "normal" men and 50 "normal" women, divided into five equal age groups, were exposed to 12 minutes of 110-decibel sound pressure level 1200- to 2400-c.p.s. random noise, and temporary threshold shift (TTS) at 2000 and 4000 c.p.s. was measured approximately two minutes after the exposure. A significantly greater TTS for females than for males was noted at 2000 c.p.s. Though no general trend with age was observed, the smallest difference in TTS between sexes was noted for the youngest group (those under 30). No significant differences in TTS attributable to age or sex were noted at 4000 c.p.s. The general conclusion is that no evidence for biological difference in susceptibility as a function of age or sex may be adduced on the basis of data from this investigation. (Authors' abstract)

559
Loeb, M.,
and J. R. Binford
SOME FACTORS INFLUENCING THE EFFECTIVE AUDITORY INTENSIVE DIFFERENCE LIMEN.— Jour. Acoust. Soc. Amer., 35 (6): 884-891. June 1963.

Observers were required to detect changes in intensity in signals of two types; (1) a continuous Gaussian noise to which increments were added randomly and infrequently; (2) a sequence of pulses, 0.5-second duration, occurring periodically at 2.5-second intervals to which increments were added infrequently and randomly. For each of the types of task, several levels of discrimination difficulty were employed. It was found that the changes in intensity of the steady noise were more readily detected than comparable changes in intensity of pulses. At intermediate difficulty levels, the number of detections of increases in the steady signal declined with time on task; and, at intermediate and high-difficulty levels, the number of detections of louder pulses declined with time. Progressive increases in response latency were also noted in some of these conditions, and there was a general tendency for false detections to decline with time on task. Possible explanations for the differential discriminations of changes in intensity of the steady and pulsed stimuli are discussed. (Authors' abstract)

560
Makarov, P. O.
[THREE FORMS OF AUDITORY THRESHOLD DEPENDENCE UPON TONE DURATION] Tri formy zavisimosti slukhovogo poroga ot ego dlitel'nosti. —Biofizika (Moskva), 8 (1): 69-76. 1963. In Russian.

The following tonal threshold curves are discussed: (1) threshold audiograms, (2) intensity-duration curves, and (3) energy-duration curves. The sum total of all three curves gives a more complete picture of the auditory excitability than each separate curve. With increasing duration of the tone that measures the threshold the audiographic curve loses its sharply defined minimum and acquires instead a broad minimal zone. The minimal threshold energy, in normal subjects, is in the range of 10-100 msec. In persons of advanced age the minimal threshold energy was absent in some frequencies, and was completely absent in persons with total incapacitation of the auditory receptors.

561
Mendelson, E. S.,
and J. L. Fletcher
SOME INDICES OF MIDDLE EAR MUSCLE REFLEX ACTIVITY. — Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Subtask MR005.13-2002.4). Report no. NAMC-ACEL-473, May 2, 1962. [41] p.

Psychometric and physiological indications are compared of individual differences in middle ear muscle reflex activity in a single group of subjects. Audiometric methods in use by investigators at Army Medical Research Laboratory (contralateral threshold shift – TS, and the reduction of noise-induced temporary threshold shift – TTS) and a manometric method developed at Air Crew Equipment Laboratory were applied in an exploratory series of experiments on 21 subjects at Fort Knox, Ky. The results were equivocal but important: Product-moment correlations between the numerically scaled indices of TS, TTS and manometric magnitudes were small and not statistically significant. Contingency correlations of the data dichotomized for each subject with respect to each measured or estimated experimental variable, including audiometric acuity and chronic exposure to noise, show that a number of significant interactions are likely to exist between certain pairs of variables. This result suggests that useful experimental standards can be devised for the assessment of the noise-protective capacities and deficiencies of the middle ear muscles in individual subjects. The combined experiments have also yielded a new finding, namely conditioned alterations in the physiological recordings from some subjects, which are explicable as behavioral adaptations resulting from exposure to loud or explosive noise. (Authors' abstract) (33 references)

562
Monty, R. A.
AUDITORY PERCEPTION OF NUMEROSITY AS AFFECTED BY NUMBER AND BY CORRECT AND INCORRECT KNOWLEDGE OF RESULTS. —Human Factors, 4 (4): 193-199. Aug. 1962.

Two experiments are reported in which the effects of correct and incorrect feedback on ability to count rapidly-produced auditory stimuli were studied. Error in counting was found to be directly related to the number of stimuli to be counted. Correct knowledge of results contributed to better performance; misinformation contributed to disruption of counting ability; and both effects were evident over time in the absence of all feedback. (Author's abstract)

563
Nixon, J. C.,
and A. Glorig
NOISE-INDUCED TEMPORARY THRESHOLD SHIFT VS. HEARING LEVEL IN FOUR INDUSTRIAL SAMPLES. — Jour. Auditory Research, 2 (2): 125-138. April 1962.

The auditory thresholds of four samples of industrial workers were measured before and after one day's exposure to their respective environments. It was found that (1) noise-induced temporary threshold shift is inversely related to resting threshold; (2) discrepancies occurred between noise level measurements and the amount of permanent and temporary threshold shifts that would be predicted on the basis of laboratory findings; (3) a noise which produces a temporary threshold shift may not be producing a permanent threshold shift, depending on the auditory sensitivity of the individuals being exposed; and (4) noise level measurements of industrial environments by themselves may not be adequate for estimating the damage risk of a noise. The daily temporary effects of the exposures should also be included in assessing the noxiousness of any environment. (Authors' abstract)

564
Piercy, J. E.,
and E. A. G. Shaw
ESTIMATION OF EQUIVALENT FREEFIELD PHYSIOLOGICAL-NOISE LEVELS BY LOUDNESS-BALANCING TECHNIQUE [Abstract]. —Jour. Acoust. Soc. America, 35 (5): 778. May 1963.

There is evidence to suggest that the pressure threshold of hearing at low frequencies is linked with the levels of physiological noise generated by rigid head motion and the inertia of the earphone. The levels in the inner ear due to the inertia of the conductive mechanism itself are, therefore, pertinent to the freefield threshold of hearing, and have been investigated as follows. The subject, whose head is driven by a pure-tone vibrator, adjusts the level of excitation for loudness balance with the ears (a) uncovered and (b) covered by a supraaural or circumaural enclosure. With a supraaural device simulating an MX41AR-TDH39 earphone, the excitation has to be reduced by approximately 18, 30, 25, 25, and 10 decibels at 40, 62.5, 125, 250, and 500 c.p.s., respectively. With a 150-cm.^{3} circumaural cavity, the corresponding values are 4-10 decibels lower. Substracting these data from measured levels of physiological noise in aural enclosures and assuming the noise to be generated solely by rigid head motion, one arrives at approximate equivalent freefield physiological-noise levels of 40, 15, 10, -10, and -10 decibels re 0.0002 dynes/cm.^{2} at 40, 62.5, 125, 250, and 500 c.p.s., respectively. (Authors' abstract)

565
Radionova, E. A.
[ON THE INTENSITY CHANGE OF A SHORT SOUND SIGNAL AT THE LEVEL OF THE FIRST NEURON IN THE AUDITORY SYSTEM] Ob izmenenii intensivnosti korotkogo zvukovogo signala na urovne pervogo neirona slukhovoi sistemy.—Akusticheskii zhurnal (Moskva), 8 (4): 447-453. 1962. In Russian.

Changes in intensity of short sound signals were studied in the cochlea at the level of the first neuron. The dependence of the amplitude of the summated nerve response and its dispersion on the intensity of the sound signal leads to the assumption that there exist two types of nerve elements located on the periphery of the auditory analyzer and differing from each other in degree of sensitivity. This difference makes it possible to measure intensity changes of short sound signals; however, it also leads to a slight reduction of differential sensitivity within the range of average intensities.

566
Riach, W.,
D. N. Elliott, and J. C. Reed
GROWTH OF LOUDNESS AND ITS RELATIONSHIP TO INTENSITY DISCRIMINATION UNDER VARIOUS LEVELS OF AUDITORY FATIGUE. — Jour. Acoust. Soc. Amer., 34 (11): 1764-1767. Nov. 1962.

Ten males were exposed to a fatiguing tone with a frequency of 2000 c.p.s., and a test tone, frequency of 2800 c.p.s. Loudness growth was determined by the method of magnitude estimation. Difference thresholds for intensity were obtained using a 3/second amplitude-modulated tone. Loudness growth and intensity difference thresholds were determined under normal conditions and under three levels of auditory fatigue, i.e., temporary threshold shifts of 10, 20, and 30 decibels. In the area of hearing where recruitment manifests itself, it was found that loudness growth under any of the three fatigue conditions differed significantly from normal, and that, as severity of fatigue increased, there were significant systematic increases in the rate of loudness growth. On the other hand, there was no significant difference in the threshold as severity of fatigue increased. The relationship of growth of loudness to differential sensitivity for intensity is of a general nature. (Authors' summary, modified)

567
Rodda, M.
THE ROLE OF THE STIMULUS IN PRODUCING TEMPORARY THRESHOLD SHIFT. — Australian Jour. Psychol. (Melbourne), 14 (2): 113-120. Aug. 1962.

Investigations were undertaken into the role of the stimulus sound in producing temporary elevations of the absolute threshold of hearing. Three groups of six subjects were used in four experiments. Temporary Threshold Shift (TTS) appears to be compounded of at least two effects—referred to as fatigue and temporary stimulation deafness. The characteristics of these two effects are discussed. (Author's summary)

568
Ross, M.,
D. A. Huntington, H. A. Newby, and R. F. Dixon
SPEECH DISCRIMINATION OF HEARING-IMPAIRED INDIVIDUALS IN NOISE: ITS RELATIONSHIP TO OTHER AUDIOMETRIC PARAMETERS.—Stanford Univ. School of Medicine, Palo Alto, Calif. (Contract AF 41(657)-376); issued by School of Aerospace Medicine. Aerospace Medical Division, Brooks Air Force Base, Tex. (Task no. 775503). Technical Documentary Report no. SAM-TDR-62-130, April 1963. iii+25 p.

This study evaluated the relationships of speech discrimination measures obtained in quiet and in noise with various distortion indexes with a group of subjects with sensorineural hearing loss. The results indicated that the most important factors associated with speech intelligibility were the extent and configuration of the hearing loss. The interrelationships among difference limens tests for frequency and intensity, linear range measures, age, and pure-tone thresholds were examined. Comparisons were made with normal-hearing listeners. (Authors' abstract) (28 references)

569
Sataloff, J.,
H. Menduke, and A. Hughes
TEMPORARY THRESHOLD SHIFT IN NORMAL AND ABNORMAL EARS. — Arch. Otolaryngol., 76 (1): 52-54. July 1962.

In subjects with unilateral hearing loss at 4,000 c.p.s., the degree of temporary threshold shift (TTS) at 4,000 after sound exposure is significantly higher in the good ear than in the ear with impaired hearing. There is some evidence that subjects with good hearing at 2,000 c.p.s. but bilateral loss at 4,000 c.p.s. have a slightly smaller TTS at 4,000 than subjects with normal hearing at both frequencies. Where subjects have bilateral losses at both 2,000 and 4,000, the 4,000 TTS becomes markedly smaller. The inverse relationship between threshold loss at 4,000 c.p.s. and degree of TTS is a group phenomenon, but marked individual variations are present. Many subjects with good hearing fail to show TTS, and some with impaired hearing do show a TTS. In subjects with approximately the same hearing level in both ears, the degree of TTS is also quite similar in both ears. (Authors' summary, modified)

570
Schubert, E. D.,
and M. C. Schultz
SOME ASPECTS OF BINAURAL SIGNAL SELECTION. — Jour. Acoust. Soc. Amer., 34 (6): 844-849. June 1962.

Two experiments were made to measure the increase in intelligibility occasioned by listening binaurally to speech imbedded in interfering signals. In the first experiment, the frequency range of the speech was restricted to one of three ranges: 200-1600, 880-2200, 1660-6100 c.p.s. The interfering signal was broad-band random noise. Under difficult listening (27% intelligibility for homophasic listening) the lowest range showed a binaural improvement of 33% for a change in interaural polarity, and of 28% for an interaural time disparity of 500 microseconds. The middle- and high-frequency ranges showed less binaural gain, but did afford some advantage to two-eared listening under difficult conditions. The second experiment compared the effects of different speech waves masking the wanted speech in binaural listening. For the maskers used, the binaural system helped most when the interfering wave was the speaker's own voice or a multiple mixture of many voices. The measured differences between homophasic and binaural listening were small but statistically reliable. The interaural differences employed (time delay and polarity reversal) were no help when the interfering wave was a female voice, another male voice, or the multiple mixture played backward. (From the authors' abstract)

571
Sekey, A.
SHORT-TERM AUDITORY FREQUENCY DISCRIMINATION.—Jour. Acoust. Soc. Amer., 35 (5): 682-690. May 1963.

The ability of listeners to detect slight changes of pitch was assessed by a forced-choice binary judgment technique. Empirical error scores were compared with the predicted performance of a decision-theory model, which incorporated a statistical receiver designed for estimating relative shifts between sound spectra. A satisfactory agreement was observed; it was subsequently argued that this provides preliminary evidence supporting the view that the auditory system was capable of adapting its parameters to stimuli of varying duration. (From the author's abstract) (29 references)

572
Selters, W.
PREDICTION OF TEMPORARY THRESHOLD SHIFT AFTER NOISE INCREASE. — Jour. Acoust. Soc. Amer., 35 (1): 99-103. Jan. 1963.

Temporary threshold shift (TTS) can be predicted as a function of exposure time and level when the noise level is constant. After a noise-level increase, if exposure time is adjusted by the equivalent-exposure rule, the usual TTS function for the higher level will predict subsequent TTS growth. Brief test periods introduce errors in exposure time, which may be corrected by multiplying the observed TTS by $(t_n+T_i)/t_n$ where t_n is exposure time and t_i is test time. An acceleration in TTS seems to occur at about six minutes. This means new equations will be necessary to predict TTS for exposure times less than six minutes. (From the author's summary)

573
Sergeant, R. L.,
and J. D. Harris
THE RELATION OF PERSTIMULATORY ADAPTATION TO OTHER SHORT-TERM THRESHOLD-SHIFTING MECHANISMS.—Jour. Speech and Hearing Research, 6 (1): 27-39. March 1963.

Perstimulatory adaptation to an interrupted tone of 1000 c.p.s. at 50 decibels sensation level was investigated with simultaneous dichotic loudness matches during five-minute runs. Five listeners made two runs each for 21 combinations having tonal durations of 10, 3, 1, 0.3, and 0.1 seconds, and recovery intervals of 3, 1, 0.3, 0.1, and .03 seconds. It was found that (a) complete adaptation to a continuous tone was accurately predicted from calculations; (b) for constant recovery intervals, an increase in tonal duration produced an increase in adaptation; (c) for constant tonal durations, an increase in recovery interval produced a decrease in amount of adaptation; (d) for durations of 0.3 to 10 seconds, approximately 50% of the adaptation expected for a continuous tone was observed when the stimulus duration was 10 times the recovery interval; (e) perstimulatory adaptation can be predicted from the duty cycle alone for stimulus durations of 0.3 to 10 seconds; and (f) at briefer durations an on-effect intrudes to interfere with these predictions. (From the authors' summary and conclusions) (31 references)

574
Stewart, J. L.
MASKING AND SPEECH PRE-EMPHASIS.—Univ. of Arizona, Tucson (Contract AF 33(616)-7800); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7233, Task no. 723305). Technical Documentary Report no. MRL-TDR-62-11, March 1962. iii+16 p.

A waveform processing representation for the subjective intensity of loudness is analyzed when a mixture of signal and noise exists. Signal suppression by noise constitutes partial masking. If a spatial pattern of excitation along the basilar membrane of the inner ear is interpreted in terms of the formant structure, preferential masking of certain formants is evidenced. Emphasis of high-frequency formants prevents differential masking. For noisy linear speech systems, an advantage of 4 db. can be achieved by means of pre-emphasis of high frequency components with a multi-slope pre-emphasis characteristic that varies from 0 db. per octave to a maximum of 8 or 9 db. per octave at high frequencies. The theory of differential masking is also applied to certain peak-clipped systems in which distortion due to clipping is equivalent to masking noise. A multi-slope pre-emphasis characteristic is predicted which varies from 0 db. per octave to 12 db. per octave at high frequencies. In addition to pre-emphasis data, the discussion contains a theory for masking and the elements of a pattern theory for speech sound recognition. (Authors' abstract)

575
Swets, J. A.
CENTRAL FACTORS IN AUDITORY FREQUENCY SELECTIVITY.—Psychological Bull., 60 (5): 429-440. Sept. 1963.

Evidence for involvement of cognitive factors makes it seem clear that the number, the frequency locations, and the widths of the critical bands which are operative in a given auditory task reflect to a substantial extent the strategy of listening that is adopted by the observer for that particular task. Central modulation of sensory information is extensive enough to make unlikely the discovery, through psychophysical methods, of a unitary peripheral process that remains stable despite changes in the observer's task, his information, and his aims. The value of a psychophysical approach to peripheral sensory mechanisms depends upon the ability to specify, and then on the ability to isolate, the central contribution to the observer's response. (Author's summary) (31 references)

576
Symons, J. R.,
and C. K. Mackay
AN INVESTIGATION OF CHANGES IN AUDITORY SENSITIVITY DURING THE PERFORMANCE OF A MENTAL TASK. —— Quart. Jour. Exper. Psychol. (Cambridge), 14 (2): 104-108. May 1962.

Auditory thresholds were measured while the subject was relaxed and while he was doing mental arithmetic. Thresholds were lowered under the second condition. Some possible explanations are briefly considered. (Authors' summary)

577
Thalmann, R.,
H. Bornschein, and F. Krejci
[THE BEHAVIOR OF THE COCHLEAR MICROPHONICS DURING TEMPORARY INCREASE OF THE INNER EAR PRESSURE] Das Verhalten der cochlearen Mikrophonpotentiale bei temporärer Erhöhung des Innenohrdrucks.—Acta oto-laryngologica (Stockholm), 56 (1): 65-74. Feb. 1963. In German, with English summary (p. 74).

The cochlear microphonics (CM) were recorded in 11 cats before, during, and after a temporary increase of the intracochlear pressure. Some of the early changes of CM were due to mechanical effects. Total ischemia of the inner ear was produced by increasing the intracochlear pressure up to 200 mm. Hg; under these circumstances the CM were reduced by 16-31 db. in 3-5 minutes. The recovery time was measured by varying the duration of ischemia between 2 and 60 min. (29 experiments); only up to 7 min. ischemia a complete recovery of the CM was observed. The recovery time increased with the duration of ischemia and amounted to about 75 minutes after 7 minutes of ischemia. If the blood flow stopped for 8-30 minutes, there was only a temporary partial recovery of the CM. After 60-minute ischemia recovery was not going beyond the level of the anaerobic post-mortem fraction CM_2. (Authors' summary)

578
Thurlow, W. R.,
and A. E. Marten
PERCEPTION OF STEADY AND INTERMITTENT SOUNDS WITH ALTERNATING NOISE-BURST STIMULI. —— Jour. Acoust. Soc. Amer., 34 (12): 1853-1858. Dec. 1962.

When the angle between sources is small, some subjects may hear only one continuous sound, provided that the repetition rate is relatively high. More commonly, however, our subjects tend to hear one steady sound and one intermittent sound when the separation angle between sources is small; they tend to hear this pattern at wider separation angles when the duration of one of the stimuli is short. When one of the bursts has short duration, and sources are separated by 30 to 50 degrees, it appears to many subjects that the short burst is markedly displaced in location. For wider angles of separation between sources, and various conditions of duration, many subjects can also hear a third steady sound between the other two. Occurrence of this latter sound has especially interesting implications for a theory of sound-localization mechanisms. (From the authors' abstract)

579
Treisman, M.
AUDITORY UNMASKING.—Jour. Acoust. Soc. America, 35 (8): 1256-1263. Aug. 1963.

A model of auditory perception is presented. It postulates a hierarchical system of tests, each depending on the operation of a signal-detection device. A prediction is derived from the model: if a masking tone presented to one ear raises the threshold for a signal at the other ear, then adding white noise to the masking ear may decrease the contralateral masking. This prediction was confirmed, and a practice effect, a tendency for the unmasking to decrease in a naive subject's second session, was found. This was explained in terms of the model, and further predictions were derived. These were that the decline in unmasking would be shown despite changes in the masking tone or signal tone, or reversal of the ears used, and that monaural masking of a tone (of the frequency of the masking tone) by white noise would also show a decline with practice, even in the opposite ear. These predictions were also confirmed. (Author's abstract)

580
Wagner, H.,
and H. J. Gerhardt
[THE EFFECT OF QUANTIFIED PURE-TONE STRESS ON THE MICROPHONICS POTENTIALS OF THE GUINEA PIG COCHLEA] Die Wirkung dosierter Reintonbelastung auf die Mikrofonpotentiale der Meerschweinchenschnecke.—Archiv für Ohren-Nasen- und Kehlkopfheilkunde (Berlin), 181 (2): 82-106. 1963. In German.

Guinea pigs were subjected to auditory stress with pure tones at the frequencies of 500, 2000, 7000, and 10,000 c.p.s. and at the intensities of 100, 110, and 120 decibels. The effects of this stress were evaluated by the frequency curve of the microphonics potentials. The results indicate a specific stress intensity for each frequency. Intensities below this critical threshold exert no damaging effect on the cochlea in spite of the time factor, while intensities above this critical threshold result in noise damage, the curve of which increases linear to the stress intensity. The critical thresholds obtained with the experimental frequencies yield a curve which reflects the critical noise stress threshold of the organ of Corti. Differences between the curve of thresholds obtained and that of the human noise thresholds found by others are discussed. Both the physical and physiological reasons for these differences are discussed. (36 references)

581
Ward, W. D.
STUDIES ON THE AURAL REFLEX. II. REDUCTION OF TEMPORARY THRESHOLD SHIFT FROM INTERMITTENT NOISE BY REFLEX ACTIVITY: IMPLICATIONS FOR DAMAGE-RISK CRITERIA. —Jour. Acoust. Soc. Amer., 34 (2): 234-241. Feb. 1962.

The temporary threshold shift (TTS) produced by intermittent noise was compared with that produced by steady noise. It was found that an on-fraction of 0.50 (30-sec. bursts of noise alternating with 30 sec. of quiet) resulted in a reduction of 50% in the TTS produced by 1200–2400- and 2400–4800-c.p.s. octave bands of noise. However, in the case of 300–600- and 600–1200-c.p.s. noise, the same on-fraction reduced the TTS to about one-third the value observed after continuous stimulation. The difference is attributed to the action of the middle ear muscles, which attenuates low-frequency sounds more than high-frequency sounds. Burst duration of 600–1200-c.p.s. noise was varied, holding the on-fraction constant at 0.50; results indicate that the same fractional reduction in TTS is produced by burst durations from 7.5 sec. to 1 min. The significance of these results in regard to damage-risk criteria is discussed. In particular, the inadequacy of the equal-energy rule in assessing the potential danger of intermittent noise exposures is emphasized. (Author's summary)

582
Wernick, J. S.,
and J. V. Tobias
CENTRAL FACTOR IN PURE-TONE AUDITORY FATIGUE [Abstract].—Jour. Acoust. Soc. America, 35 (5): 787. May 1963.

Subjects were presented with a 4000-c.p.s., 40-decibel tone for 3 minutes under conditions of (a) a mental task or (b) reverie. Pre- and post-fatigue thresholds were measured with a switched (0.2 second on, 0.2 second off) 4000-c.p.s. tone. Subjects consistently showed greater temporary threshold shift and longer recovery time when the fatiguing tone was presented in the mental-task condition. Results thus indicate a central factor in pure-tone auditory fatigue. It is suggested that the degree of effect of a fatiguing tone is a function of the listener's degree of mental activity during stimulation. (From the authors' abstract)

583
Westernhagen, B. V.
[DOES THE SENSORY THRESHOLD END AT 1000 C.P.S. OR IS IT POSSIBLE TO FEEL BONE CONDUCTION VALUES OF 1500 C.P.S. UP TO 2000 C.P.S.] Endet die Fühlschwelle bei 1000 Hz oder können bei 1500 Hz bzw. 2000 Hz Knochenleitungswerte noch gefühlt werden ?—HNO (Berlin), 11 (3): 70-71. March 1963. In German.

The author attempts to show by means of audiograms the difference between sensation thresholds for bone conduction of sound waves and hearing thresholds. He cautions that a possibility exists that even at 1500 c.p.s. and sometimes also 2000 c.p.s. audiometric bone conduction values are sensed and not heared.

584
Zwicker, E.,
and H. N. Wright
TEMPORAL SUMMATION FOR TONES IN NARROW-BAND NOISE.—Jour. Acoust. Soc. America, 35 (5): 691-699. May 1963.

Temporal summation was measured for tones within, above, and below a narrow-band noise centered at 1000 c.p.s. as a function of the time interval between the onset of the noise and the onset of the tones. The results show that the theory of temporal auditory summation is sufficient to predict the threshold of audibility for tones in a steady-state condition where there exists a threshold shift not caused by the physical presence of a masking stimulus. Variation of the time interval between the onset of the narrow-band noise and the tones did not produce results different from those found in the steady state. (Authors' abstract)

d. Proprioception
(Incl. Vestibular Function)

585
Cohen, B.,
and J. Suzuki
EYE MOVEMENTS PRODUCED BY VESTIBULAR NERVE STIMULATION [Abstract].—Electroencephalography and Clinical Neurophysiol. (Amsterdam), 15 (1): 152. Feb. 1963.

Eye movements which follow stimulus frequencies up to 100/sec. can be produced in cats by stimulating vestibular nerve branches at semicircular canals with double pulses and pulse trains. The amplitude of movements can be controlled by varying the strength and timing of the pulses. These movements are rapid shifts from the mid-position followed by a somewhat slower return. At train frequencies of 1-5/sec. they resemble nystagmus. A single stimulus produces only small extra-ocular muscle potentials and no visible eye movements. The effectiveness of double pulse and pulse train stimulation in evoking eye movements is due to enhanced excitability evoked by the first vestibular nerve stimulus. These data indicate that stimuli are effective in producing eye movements when they evoke enhanced central excitability which couples the vestibular and oculomotor systems. Single stimuli are effective only after some repetition for this reason. Double pulse and pulse train stimulation is a valuable method for studying eye movements and interconnections of the vestibular-oculomotor system. (Quoted in part)

586
Dzendolet, E.
SINUSOIDAL ELECTRICAL STIMULATION OF THE HUMAN VESTIBULAR APPARATUS.—Perceptual and Motor Skills, 17 (1): 171-185. Aug. 1963.

Sinusoidal electrical stimulation with eight frequencies ranging from 0.030 to 4.0 c.p.s. was applied between the mastoid processes of five males. Subjective reports of the presence of a sensation, and also of its quality were recorded and used to determine absolute threshold (RL) at all frequencies. These curves of RL versus frequency were termed electrical vestibulograms. The reported qualities were classed into three main categories: (a) swaying sideways, (b) swaying forward and backward, and (c) sideways oscillation of head and body. Subjective and objective electrical vestibulograms were similar in shape, being U-shaped between 0.50 and 4.0 c.p.s., and approximately linear between 0.030 and 0.50 c.p.s., but with the subjective having a slope of about one, and the objective, of zero. The objective vestibulogram was lower than the subjective one. Sway frequencies were also estimated, using a new technique, and were found to be proportional to the stimulus, but the proportionality varied with the frequency. Fluctuation in amplitude of swaying to a constant amplitude stimulus was observed separately in two subjects at each of two frequencies. The results were interpreted as supporting a central rather than peripheral adaptation hypothesis. (From the author's summary)

587
Georgiev, V. I.
BLOOD PRESSURE CHANGES IN VARIOUS VASCULAR REGIONS ON STIMULATION OF SKELETAL MUSCLE PROPRIOCEPTORS.—Sechenov Physiol. Jour. USSR (Pergamon Press, New York), 47 (8): 1068-1075. Feb. 1962.

English translation of: Izmeneniia krovianogo davleniia v razlichnykh sosudistykh oblastiakh pri razdrazhenii proprioretseptorov skeletnoi myshtsy. —Fiziologicheskii zhurnal SSSR (Moskva), 47 (8): 976-982. Aug. 1961. In Russian.

The adequate proprioceptor stimulation produced by stretching the cat gastrocnemius with a weight of 1.5-2 kg. led to increase of general blood pressure in the carotid artery and in other arteries connected with the internal organs and posterior extremities of the animal. The degree of arterial pressure increase was not the same in the different vascular regions. The greatest changes were seen in the hemorrhoidal artery and the artery of the abdominal cavity, while those in the femoral artery were less pronounced. These changes developed before the occurrence of changes in the general blood pressure and disappeared earlier when the weight was removed. The increase of pressure in the brachial artery during loading was generally less than the increase in general blood pressure and developed later. The stroke volume of the heart was unchanged or slightly reduced under these conditions. The pulse rate was unchanged in a great majority of instances and only in a few cases did it increase slightly after the general blood pressure had risen. (Author's conclusions)

588
Grandjean, E.,
T. Abelin, and A. Rhiner
[AN APPARATUS FOR THE MEASUREMENT OF EQUILIBRIUM MOVEMENTS] Eine Apparatur zur Messung der Gleichgewichtsbewegungen.—Schweizerische medizinische Wochenschrift (Basel), 93 (33): 1028-1030. Aug. 17, 1963. In German, with English summary (p. 1030).

A new apparatus for the quantitative measurement of equilibrium movements in the standing subject is described. The body movements are transmitted to a plate with contact points in high density, and the number of contacts is recorded by electronic counter. An initial series of experiments in 27 subjects was conducted to determine the range of variation of the measurements in non-standardized conditions. (Authors' summary)

589
Hixson, W. C.,
and J. I. Niven
FREQUENCY RESPONSE OF THE HUMAN SEMICIRCULAR CANALS. II. NYSTAGMUS PHASE SHIFT AS A MEASURE OF NONLINEARITIES. — Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1). Report no. 73, July 26, 1962. i+17 p.

The lag of the steady-state nystagmic eye velocity response following a sinusoidal angular acceleration stimulus is used to quantify the transfer function for the skull-acceleration-to-cupula-endolymph-motion transducer system. The experimental measure of this lag was derived from corneoretinal potential recordings and expressed in standard electrical degree form to describe the phase difference angle between stimulus and response as a function of both frequency and magnitude of the stimulus. The effects of sinusoidal angular acceleration stimuli ranging in frequency from 0.02 c.p.s. to 0.20 c.p.s. and in peak acceleration level from 10 deg./sec.^{2} to 80 deg./sec.^{2} were evaluated for four subjects. The nystagmic phase shift data demonstrate independence of stimulus magnitude only at the upper frequencies; at the lower frequencies, phase lag varied inversely with the peak acceleration level indicating nonlinear operation. The experimental and theoretical considerations involved in using the nystagmus transition technique to study these nonlinearities are discussed and an illustrative application of their quantification is presented. (From the authors' summary)

590
Kosmarskaia, E. N.
[REACTION OF THE NERVE CELLS OF THE BRAIN TO PROLONGED INCREASE OF STIMULI FROM THE PERIPHERAL RECEPTORS] Reaktsiia nervnykh kletok golovnogo mozga na dlitel'noe uvelichenie razdrazhenii ot perifericheskikh retseptorov. — Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 53 (6): 88-91. June 1962. In Russian, with English summary (p. 91).

The vestibular apparatus of adult rabbits was stimulated by horizontal rotation, i.e., the animals were rotated on a platform 2-3 times a day for 10-15 minutes for a total of 18-19 days. As a result of the increased vestibular stimulation the neurons in three nuclei (triangular nucleus and the nuclei of the oculomotor and abducens nerves) became hypertrophied, the greatest enlargement of the cell bodies occurring in the triangular nucleus. The cell nucleus in comparison with the cell body did not enlarge to a significant extent. (From the author's summary)

591
Kylstra, J.
[PERCEPTION OF TILT] Perceptie van hellingen. —Aeromedica acta (Soesterberg, Netherlands), 8: 127-134. 1961-1962. In Dutch.

Twenty individuals were subjected to a preliminary training session in perception of changes in position in a modified Link trainer, which permitted tilts around the horizontal and vertical axes. Thereafter they were tested in postural orientation, whereby five runs on the Link trainer were without distractions, and five other runs included distractions while the subjects were reading difficult material in small print under a low illumination. Changes in the gradient around the horizontal axis were perceived between 1-1/2° and 5°. The average change perceived was 1.4° without distraction, and 1.6° with distraction. 70% of the subjects perceived tilts of 1°. The reaction speed to changes at the rate of 1/2 to 1-1/2° was 2 seconds without distraction and 2-1/2 seconds with distraction. 89% of the reactions averaged 3° and 5 seconds. Postural changes around the vertical axis were perceived in the range between 1.6° and 4°. 66% of the subjects perceived slopes of 1°. The average reaction time was 2.2 seconds with a maximum of 8 seconds. 92% of reactions averaged 3° in 5 seconds. Changes in position smaller than 1/2° per second were perceived only after progression. However, these data may be applied only to a straight flight course, since all turns involve disorientation.

592
Miodoński, J.
PHYSIOLOGICAL ASYMMETRIES IN VESTIBULAR REACTIONS.—Arch. Otolaryngol, 78 (2): 119-126. Aug. 1963.

The eyeballs are functionally suspended in the orbit as in a gyrostat and carried by the current of surrounding lymph; this is the slow phase of nystagmus. The quick phase is in the opposite direction. In a normal individual, every head movement is connected with a corresponding stimulation of the whole vestibular system. Irritation of the vestibular apparatus which does not correspond to the work of the muscles (movement of the head) causes a feeling of vertigo. When stimulation of the vestibular apparatus creates a sensation of vertigo in the plane perpendicular to the vector of gravity, no inclination or postural reaction follows. When the plane of created vertigo is not perpendicular to the vector of gravity, then there appear inclination reactions and sometimes marked postural reflexes. Caloric stimulation unconnected with corresponding movements causes vertigo. Reactions of the head and trunk may be clinically useful as a test of the otolithic apparatus. If a patient is rotated in the turning chair, the semicircular canals are not stimulated even during quick rotation at a uniform speed, but both otolithic apparatuses are very markedly stimulated. The stimuli from the right and left otolithic apparatus cancel each other out. If, however, one of the vestibular apparatus is damaged, then the inclination reaction follows during the turning test carried out without support of trunk or head. The symmetrical reaction of the left and right otolithic apparatus may be connected in some complexes of movement which do not occur with complete symmetry. Hence may be explained the greater facility experienced by right-handed persons in turning toward the left on a bicycle, or an airplane, the right otolithic apparatus coming into action. (Author's summary, modified)

593
Molnár, L.
EFFECT OF LABYRINTHINE STIMULATION ON THE CORTICAL AND SUBCORTICAL ELECTRICAL ACTIVITY OF THE CAT'S BRAIN [Abstract].—Electroencephalography and Clinical Neurophysiol. (Amsterdam), 15 (2): 341. April 1963.

Electroencephalographic recording with macroelectrodes in the waking cat reveals that only about 6% of rotations induce changes (synchronisation) in the electrical activity of the reticular formation in the brain-stem. Synchronization may be observed during negative acceleration. The activity of the ventral part of the hippocampus is desynchronized during the whole of the rotational procedure. Chloralose spikes in the reticular formation, the hippocampus, the hypothalamus, and the cerebral and cerebellar cortices are greatly influenced by rotation; the changes reach a higher intensity and appear after shorter latency in the subcortical regions and in the hippocampus than in the cerebral and cerebellar cortices. The changes—facilitation or inhibition—are dependent on the direction of rotation and on the character of the pre-rotatory activity in the reticular formation. Following intravenous administration of strychnine, negative acceleration will elicit spike discharges in the subcortical regions as well as in the archi- and neocortex. These spikes are suppressed by positive acceleration. After intravenous administration of the drug, however, spikes may appear also during positive acceleration in about one quarter of the rotations, depending on the background activity of the reticular formation. These observations show that the effects of rotation—facilitation or inhibition—depend on the actual functional state of the reticular formation of the brain-stem. (Quoted in part)

594
Money, K. E.,
and J. W. Scott
FUNCTIONS OF SEPARATE SENSORY RECEPTORS OF NONAUDITORY LABYRINTH OF THE CAT. — Amer. Jour. Physiol., 202 (6): 1211-1220. June 1962.

A technique for plugging individual semicircular canals of cats was developed, and it was established that the plugging of a semicircular canal completely blocked its receptivity without influencing the functions of the other vestibular receptors. It was found that cats with all six semicircular canals plugged were lacking all sensitivity to angular acceleration, but they retained normal responses to linear acceleration. Results of several vestibular tests led to the conclusion that the vertical semicircular canals initiate corrections for fast angular displacements from the normal orientation when the displacements are about horizontal axes and that the otoliths initiate corrections for slow angular displacements about horizontal axes. In tests of single horizontal canals, the durations of postrotatory nystagmus were the same after rotations in opposite directions. It was concluded that in the intact animal both horizontal semicircular canals contribute equally to reception of angular acceleration in both directions. (Authors' abstract)

595
Proctor, L. R.,
and C. Fernandez
STUDIES ON HABITUATION OF VESTIBULAR REFLEXES. IV. EFFECT OF CALORIC STIMULATION IN BLINDFOLDED CATS.—Acta otolaryngologica (Stockholm), 56 (4): 500-508. May 1963.

The effect of vision upon habituation of nystagmus elicited by repetitive caloric stimulation was studied in cats. The animals were blindfolded or enclosed in a lightproof room. One trial consisting of 15 to 25 caloric tests in one ear with water at 20° C. was used for inducing habituation. The observations regarding acquisition, retention, and transfer of habituation in darkness confirm the opinion that vision may have some effect upon development of the phenomenon, but certainly it is not a critical factor. The general pattern of the response decline is similar to that found for animals habituated in a lighted room, i.e., that habituation of the nystagmic response to repetitive caloric stimulation occurs whether the animal is blindfolded, in total darkness, or in full light. (Authors' abstract, modified)

596
Walsh, E. G.
THE PERCEPTION OF RHYTHMICALLY REPEATED LINEAR MOTION IN THE HORIZONTAL PLANE. — Brit. Jour. Psychol. (London), 53 (4): 439-445. Nov. 1962.

Normal subjects were exposed to linear motion rhythmically repeated at rates of 1 to 1/9 cycle per second. With horizontal oscillations of 1/3 cycle/sec. the sensations of moving came at the turning-points of the swing. The person felt he was moving most rapidly when he was momentarily stationary. The central nervous system interprets acceleration as velocity under these circumstances. At times the first sensation of moving in one direction came while the person was traveling rapidly in the opposite way. At 1 cycle per second the sensations were in time with the movements as they occurred. Threshold data indicate that the peak acceleration adequately describes the stimulus at 1/3 and 1/9 cycle per second. The findings are discussed in relation to the behavior of the otolith organs and may have a bearing on possible explanations of motion sickness. (Author's summary)

e. Complex Perceptive Phenomena (Including Spatial Orientation, Sensory Illusions, etc.)

597
Backus, P. S.
AN EXPERIMENTAL NOTE ON HYPNOTIC ABLATION OF OPTOKINETIC NYSTAGMUS. — Amer. Jour. Clinical Hypnosis, 4 (3): 184. Jan. 1962.

Optokinetic nystagmus was induced by looking at a revolving drum with alternating black and white stripes in (a) a non-hypnotized subject, and (b) the same subject in a deep somnambulistic trance. Nystagmus was abolished by suggestions of negative hallucinations (the drum was "removed" from the subject's sight) and of positive hallucinations (the subject sees the room in "absence" of the drum). The results support other findings that the optokinetic reflex can be suppressed by hypnotic suggestion in the presence of retinal stimulation.

598
Baird, J. C.
RETINAL AND ASSUMED SIZE CUES AS DETERMINANTS OF SIZE AND DISTANCE PERCEPTION. —Jour. Exper. Psychol., 66 (2): 155-162. Aug. 1963.

Three experiments were conducted to determine the importance of the retinal image in perception of size and distance. The observers were given two different types of instructions. One set of instructions (objective) emphasized judging physical size while the other set (analytic) required size judgments in terms of the retinal image. When other visual cues were eliminated, it was found that the assumed size of an object was an important determiner of its estimated size and distance under objective instructions but not under analytic instructions. When objective instructions were given, size and distance estimates were positively correlated but when analytic instructions were given no significant relationship was found between judgments of size and distance. (Author's summary) (25 references)

599
Baker, E. J.,
and E. A. Alluisi
INFORMATION HANDLING ASPECTS OF VISUAL AND AUDITORY FORM PERCEPTION. — Jour. Engineering Psychol., 1 (4): 159-179. Oct. 1962.

Several tests were made concerning the identification of visual figures (patterns). In the first experiment, a speed-of-identification task, response time increased with increasing figure complexity and the use of a constrained sampling rule rather than a random rule. Performance was unaffected by size of figure and size of figure detail. In the second experiment, visual noise (distortion of contours) was added to the figures. Response time increased linearly with increases in the amount of noise from no noise through 25% noise. The smaller noise detail used had a less disturbing effect on performance than the larger size; this was especially noticeable at the higher noise level. Cross-modality (auditory-visual) effects were investigated in the third experiment. Tones varying in pitch were used as stimuli to construct figures with varying column heights. Response time increased with increases in complexity and with use of the constrained sampling rule. In the final experiment the generality of certain conclusions previously reached was tested across perceptual modalities and tasks. (27 references)

600
Bauermeister, M.,
S. Wapner, and H. Werner
SEX DIFFERENCES IN THE PERCEPTION OF APPARENT VERTICALITY AND APPARENT BODY POSITION UNDER CONDITIONS OF BODY TILT.—Jour. Personality, 31 (3): 394-407. Sept. 1963.

Forty male and 40 female subjects indicated by means of a luminescent rod (a) the vertical direction in space (apparent vertical), and (b) the direction of their longitudinal body axis (apparent body position), under tilt ranging from 90° left, through upright, to 90° right. The following results were obtained: no sex differences were observed for apparent verticality; significant sex differences were observed for apparent body position. Female subjects as compared to male subjects perceived the longitudinal axis of their own bodies in positions which deviated from the objective body axis (a) more toward the side of body tilt, and (b) more toward the initial position of the luminescent rod. These results are interpreted in terms of an organismic theory of perception. (Authors' summary)

601
Beauchamp, G.,
R. Bordes, G. Nicolas, and P. Robert
[DISADAPTATION SYNDROME IN THE PILOT OR PSYCHOLABYRINTHINE SYNDROME] Le syndrome de désadaptation chez le navigant ou syndrome psycholabyrinthique.—Revue de médecine aéronautique (Paris), 2 (5): 49-52. Nov.-Dec. 1962. In French.

The psycho-labyrinthine syndrome observed in flying personnel with correlated nystagmus sets in quite rapidly, is usually manifested by labyrinthine disturbances revealed by cupulometric examination, and is generally a manifestation of psychological disturbances which may be minor or major. Five case histories, with corresponding cupulograms, are given.

602
Bell, R. G.
HUMAN PERCEPTION OF OBJECTS, USING PULSED SOUND [Abstract].—Jour. Acoust. Soc. America, 35 (5): 788. May 1963.

The experiments were conducted in an anechoic environment, using an acoustic pulse-train generator as a signal source and unaided human ears as receptors. The effect of systematic permutation of parameters associated with the outgoing signal on the size threshold for object perception was measured. An attempt was made to define an optimum signal for purposes of human target detection. Subjects were able to perceive aluminum cylinders 1/20 inch in diameter at a distance of 10 ft. using a near-optimum signal. A theoretical model was formulated explaining the experimental results in terms of acoustic-scattering theory and the parameters of human hearing. Additional experiments were performed that measured object size, shape, and distance discrimination. (From the author's abstract)

603
Bochenek, Z.,
and F. C. Ormerod
THE INHIBITORY ACTION OF CERTAIN SUBSTANCES ON THE RESPONSE TO VESTIBULAR STIMULATION.—Institute of Laryngology and Otology and Royal National Throat, Nose and Ear Hospital Reports, 12 (1961-62): 183-188. [1962].

Eight subjects were treated with avomine, hyoscine, sodium amytal, and alcohol to see the effects on the static labyrinth. Positional and rotary tests for nystagmus were given, as well as caloric tests. In the rotational tests sodium amytal showed the greatest degree of inhibition of nystagmus, but it produced feelings of nausea, vertigo, and faintness. On the other hand the antihistaminics, such as avomine, produced the best results combined with the least side effects.

604
Bornschein, H.
[THEORY AND PRACTICAL SIGNIFICANCE OF THE VESTIBULAR CORIOLIS EFFECT] Theorie und praktische Bedeutung des vestibularen Coriolis-Effektes. — Monatsschrift für Ohrenheilkunde und Laryngo-Rhinologie (Wien and Innsbruck), 96 (2): 45-49. Feb. 1962. In German.

The vestibular Coriolis effect caused by certain head movements during constant whole-body rotation manifests itself through sensation of subjective rotation, nystagmus, and nausea. The mechanics of the semicircular canals and the resulting misperception are analyzed on the basis of the Mach-Breuer flow theory. The influence of different stimulus factors on the vestibular Coriolis effect is discussed in detail. Attention is called to the fact that the effect is not weakened by slower head movements as long as the duration of the movement is not more than 6 seconds. The direction of the effect is a function of the direction and extent of the head movement and not of the initial head position. The vestibular Coriolis effect is of importance in aviation medicine, clinical vestibular tests, and particularly space medicine in view of the proposed rotation of space ships and space stations. A long-term sojourn in a slowly rotating room results in progressive weakening of the effect. After-reactions indicate that it is not due to fatigue or adaptation directly, but is based on compensation within the central nervous system. (Author's summary, modified)

605
Bornschein, H.,
and G. Schubert
[THE DIRECTION OF THE VESTIBULAR CORIOLIS-EFFECT] Die Richtung des vestibulären Coriolis-Effektes. — Zeitschrift für Biologie (München), 113 (2): 145-160. March 1962. In German, with English summary (p. 160).

Coriolis nystagmus was produced by head movements during rotation. Its direction was measured in man and guinea pig by recording the vector of the electronystagmogram. For comparison theoretical values of these vectors were calculated and demonstrated in a physical model of the semicircular canal system. The values obtained for man were in full agreement with the theoretical model, while those for the guinea pig deviated systematically. Several explanations are offered. (Authors' summary, modified)

606
Brandt, U.
THE CAUSE AND PRACTICAL IMPORTANCE OF OCULOGRAVIC ILLUSIONS. — Acta oto-laryngologica (Stockholm), 54 (2): 127-135. Feb. 1962.

The oculogravic illusion can be interpreted as a specific otolith response to a stimulus consisting of linear acceleration. Two cases of acquired labyrinthine areflexia were examined on the human

centrifuge, the illusion being measured by a special technique. Abnormal illusion curves much unlike those recorded in the congenitally deaf may be obtained at the end of the "destruction stage"; compensation with illusion curves resembling those of healthy individuals developed in a comparatively short time. The oculogravic illusion cannot be accepted as a selective measure for otolith sensitivity. In connection with a discussion of analogies, comparing oculogravic and oculogyral illusions, it is suggested that the "lag effect" (i.e., the time necessary for reorientation on rapid changes of the angle of incidence of the resultant vector) may offer a more adequate expression for static sensibility. (From the author's summary)

607
Braunstein, M. L.
THE PERCEPTION OF DEPTH THROUGH MOTION. —Psychological Bull., 59 (5): 422-433. Sept. 1962.

This is a review of a class of depth perception phenomena in which a visual pattern seen as two-dimensional when stationary, is transformed in some manner which to some observers appears to be a form moving in three dimensions, or a three-dimensional object in motion, or a three-dimensional scene. The kinetic depth phenomena are closely related to "motion perspective" (perspective of the change of position). The following phenomena and research approaches are reviewed: the windmill and fan illusions, Lissajous figures, stereokinetic phenomena, Metzger's research, Johansson's research, kinetic depth effect, experiments with slanted surfaces, and Green's computer methodology. (34 references)

608
Braunstein, M. L.
DEPTH PERCEPTION IN ROTATING DOT PATTERNS: EFFECTS OF NUMEROSITY AND PERSPECTIVE. — Jour. Applied Psychol., 64 (4): 415-420. Oct. 1962.

Motion picture sequences of spots representing projections of points rotating in three dimensions were produced using the CRT output of a digital computer. The sequences varied in number of points and perspective and were viewed monocularly. A paired comparison method was used to elicit judgments of the relative strength of the depth impressions created by the sequences and of the relative coherence of the patterns while in motion. Judged strength of the depth impression increased with increasing numbers of spots and, to a lesser degree, with increasing perspective. Subjective coherence decreased with increasing perspective. The role of perceived coherence of moving patterns in depth perception and the effects of variations in perspective on depth judgments are discussed. (Author's summary, modified)

609
Bzhalava, I. T.
[FIGURAL AFTER-EFFECT OR THE CONTRAST ILLUSION] Kontrastnaia illiuziia ili effekt posledeistviia figury. — Voprosy psikhologii (Moskva), 8 (5): 57-69. Sept.-Oct. 1962. In Russian, with English summary (p. 69).

The figural aftereffects are the analogues of the contrast illusion. A T-figure which has replaced an I-figure does not appear reduced. A figure outside the sphere of action of the saturation mechanism is variable. It undergoes an illusory increase and therefore the second figure of equal size looks smaller. The appearance of the contrast illusion raises doubts as to the existence of an electrically saturated field, even with the volume of the T-figure being twice the volume of the I-figure. There is no experimental indication of an influence of the I-figure on the T-figure, but the opposite effect is noted. It is concluded that the contrast illusion has its origin in a change in set.

610
Calvi, G.
[DEPTH PERCEPTION ON MOVING SIGNALS] La percezione della profondità su segnali in movimento.—Archivio di psicologia neurologia e psichiatria (Milano), 23 (5): 443-454. Sept.-Oct. 1962. In Italian, with English summary (p. 454).

By means of a pilot experiment, depth perception determined by signals moving on a surface and from a point in space towards the observer were studied. The results showed that the subjects perceived a constantly reduced distance between one signal and another with the increase of the speed of movement of the same signals. Interpretation of the phenomenon is still premature and may depend on sensory-perceptive laws as well as on more complex psychic factors. It may also imply a perceptive deformation of depth. (Author's summary, modified)

611
Caporale, R.
[BEHAVIOR OF OCULAR NYSTAGMUS OF LABYRINTHINE ORIGIN IN MAN AND RABBIT SUBJECTED TO RADIAL ACCELERATION] Comportamento del nistagmo oculare d'origine labirintica nell'uomo e nel coniglio sottoposti ad accelerazione radiale. — Rivista di medicina aeronautica e spaziale (Roma), 25 (4): 653-666. Oct.-Dec. 1962. In Italian, with English summary (p. 664).

The following three tests were performed: (1) analysis of the behavior of ocular nystagmus in recently hemilabyrinthectomized rabbits during centrifugation at 1, 2, and 3 g; (2) exposure to rotatory stimulation and simultaneous centrifugation of a second group of rabbits; and (3) registration of nystagmus in man as induced by caloric stimulation during positive acceleration in the human centrifuge. The results show that ocular nystagmus, however elicited, decreases in frequency and duration when acceleration in the centrifuge reaches 1 g. The mechanism by which excess gravity inhibits nystagmus cannot be established. However, it is postulated that the increase in gravity produces its effects either peripherally through a retarding action at eyeball level, through the complex cortico-vestibular-cerebellar system, or even at the level of the otoliths. It is assumed that if the inhibition of nystagmus is due to the action of excess gravity on the labyrinth, the threshold of vestibular reflectiveness is enhanced at zero-gravity conditions.

612
Carlson, V. R.,
and E. P. Tassone
SIZE-CONSTANCY AND VISUAL ACUITY.—Perceptual and Motor Skills, 16 (1): 223-228. Feb. 1963.

Young adults and aging individuals were given size-constancy and visual acuity tests with the test-objects at moderate distances. Both groups performed the size-constancy task under an apparent-size instruction and an objective-size instruction. The older subjects were tested with and without their normal eyeglass corrections. Size constancy and acuity were negatively correlated when the older subjects did not wear their glasses, unrelated when they did. The correlation was also negative for the group of younger subjects who received the apparent-size instruction first, but positive for the group who received the objective-size instruction first. The older subjects were less differentially responsive to instructions, and order made no difference for them. The results indicate that a loss in acuity does not affect size-constancy in the same manner as an experimental reduction of the stimulating conditions. (Authors' summary)

613
Clark, B.,
and A. Graybiel
PERCEPTION OF THE POSTURAL VERTICAL IN NORMALS AND SUBJECTS WITH LABYRINTHINE DEFECTS.—Jour. Exper. Psychol., 65 (5): 490-494. May 1963.

Nine normal men and ten men with vestibular defects were studied in a lateral tilt chair for 30 successive settings to the postural vertical. A significant decrease in the average error was found for both groups. The normal subjects exhibited smaller average errors; however, the differences were small particularly after 15 trials and were not statistically significant. (Authors' summary)

614
Collins, W. E.,
and R. H. Poe
AMPHETAMINE, AROUSAL, AND HUMAN VESTIBULAR NYSTAGMUS. — Jour. Pharmacol. and Exper. Therapeutics, 138 (1): 120-125. Oct. 1962.

A normal clinical dosage of amphetamine (12 mg.) and a placebo were administered to six rotation-naive subjects and six rotation-experienced subjects by the "double-blind" technique. The drug produced significant increases in cardiovascular activity. However, it did not affect significantly the total amount of slow-phase nystagmus induced by rotation when instructions influencing mental activity were employed. In agreement with other studies, the mentally active state resulted in greater output and longer durations of nystagmus than did the relaxed state. (Authors' summary)

615
Collins, W. E.
MANIPULATION OF AROUSAL AND ITS EFFECTS ON HUMAN VESTIBULAR NYSTAGMUS INDUCED BY CALORIC IRRIGATION AND ANGULAR ACCELERATIONS. — Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Okla. Report no. 62-17, Oct. 1962. 12 p.

Investigations concerned with the effects of subjective states on vestibular nystagmus are reviewed. Methods of controlling such states are discussed. Data indicate that the significant factor in subject orientation is a state of arousal, defined in terms of mental activity. Continuous, concerted attending to a task yields a brisk, long-duration nystagmus. If responses to a task require less attention with repetition, or if subjects are not kept alert, a significant reduction in nystagmus output may occur. Knowledge of subjective states is a prerequisite for proper evaluation of vestibular responses in theoretical formulations, in many clinical situations, and in ascertaining vestibular components associated with air- or space-vehicle maneuvers. (Author's abstract) (37 references)

616
Collins, W. S.
EFFECTS ON MENTAL SET UPON VESTIBULAR NYSTAGMUS. — Jour. Exper. Psychol., 63 (2): 191-197. Feb. 1962.

During rotational stimulation subjects were instructed, in different test sessions, to: (a) do mental arithmetic, (b) make estimates of subjective velocity, (c) reproduce durations of sound stimuli, and (d) assume a state of reverie. The reverie state resulted in significantly less recorded nystagmus than the other three tasks, while mental arithmetic was the most efficacious means of obtaining a vigorous response. A factor of sustained alertness seems to be an important condition for the maintenance of nystagmus. (Author's summary)

617
Cormack, R. H.
OCULAR TRACKING AS A MEASURE OF AUTOKINETIC MOVEMENT.—Perceptual and Motor Skills, 17 (1): 223-226. Aug. 1963.

A method for measuring autokinetic movement in which the subject fixates the apparent starting point of the movement rather than the stimulus light is described. Reliability data and theoretical considerations point to the potential usefulness of this measure as a dependent variable for studying effects which are localized in the visual field. (Author's summary, modified)

618
Crampton, G. H.
DIRECTIONAL IMBALANCE OF VESTIBULAR NYSTAGMUS IN CAT FOLLOWING REPEATED UNDIRECTIONAL ANGULAR ACCELERATION.—Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X99-28-001, Task no. 02). Report no. 529, Jan. 22, 1962. i+13 p.

Cats were subjected to schedules of angular accelerations to determine if a marked nystagmic habituation to accelerations of one direction would "transfer" and thus cause a reduced nystagmus to accelerations of the opposite direction. All testing was in total darkness and animals were maintained in a state of continuous arousal with d-amphetamine. It was found that habituation does not transfer, that nystagmus in the untested direction remains undiminished, and that a directional imbalance is the result. (Author's abstract)

619
Crovitz, H. F.
DIRECTIONAL DIFFERENCES IN AUTOKINESIS BASED ON STIMULATION OF THE LEFT VERSUS THE RIGHT EYE. — Perceptual and Motor Skills, 15 (3): 631-634. Dec. 1962.

The initial direction of the lateral component in autokinesis was studied. When the fovea of the left eye was stimulated, illusory movement was to the left and when the right eye was stimulated, it was to the right. A theory is presented which relates autokinesis to innervation for eye movement. (Author's summary, modified)

620
Dowd, P. J.,
G. L. Anstadt, and E. Koegel
A NEW CHRONICALLY IMPLANTED ELECTRODE FOR RECORDING NYSTAGMUS IN ANIMAL.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775203). Technical Documentary Report no. SAM-TDR-62-125, Nov. 1962. iii+7 p.

A new type of chronic electrode was developed for recording the displacement of the electrical axis of the eye. Surgical technic for implanting this type of electrode at the desirable anatomic sites is described. Recordings of cornea-retinal displacements in response to various vestibular stimuli are demonstrated. Microscopic examination supports this chronic electrode implantation in its findings of small inflammatory infiltrate in the penetrated tissue areas. (Authors' summary)

621
Eckel, W.,
G. Kuipers, and D. Wendt
[ELECTRONYSTAGMOGRAPHIC INVESTIGATIONS ON THE VARIABILITY OF THE EXPERIMENTAL NYSTAGMUS IN RELATION TO DIURNAL RHYTHM AND DIFFERENT STATES OF CONSCIOUSNESS] Elektronystagmographische Untersuchungen zur tageszeitlichen und durch verschiedene Bewusstseinsgrade bedingten Variabilität des experimentellen Nystagmus.—Archiv für Ohren- Nasen- und Kehlkopfheilkunde (Berlin), 181 (2): 175-198. 1963. In German.

Two groups of subjects were used in a series of experiments exploring thermally induced and rotatory nystagmus. In all cases the labyrinthine stimulation was carried out on both sides. The results did not yield any generalization on the behavior of mean values or the variance of either the per- or postrotatory nystagmus or the caloric nystagmus. The mean values of the right and left rotation for the per- and postrotatory nystagmus were essentially similar, but the variability of these values was influenced by the time of the day. Similarly the values of the caloric nystagmus showed a diurnal influence. Certain other observations are cited.

622
Edwards, E.
THE INTEGRATION OF SPACED SIGNALS.—Ergonomics (London), 6 (2): 143-152. April 1963.

Experiments are described in which subjects were required to estimate the mean position of a pointer which appeared successively in a number of positions upon an ungraduated scale. Two types of display were used; the first was a horizontal linear one and the second was semicircular. In each case the subject was required to make his response on a scale identical in shape and size to the corresponding display. The two major independent variables were the number of signals to be integrated, and the pattern of presentation of these signals. The results show that both these variables have an important effect upon the accuracy of judgment of the mean. The concept 'amount of information' as used in communication theory is used to compare the performances on the two types of display used. Further comparisons are drawn between the experiments described here and those of other investigators dealing with signals presented simultaneously. (From the author's abstract)

623
Elfner, L. F.,
and H. A. Page
AUTOKINETIC ENHANCEMENT AS A FUNCTION OF FLICKER.—Perceptual and Motor Skills, 17 (1): 299-301. Aug. 1963.

The apparent movement of a stationary spot of light on a homogeneous background is perceived with shorter latency and greater spatial displacement when the spot is flickering than when fused. The enhancing effect of flicker is more pronounced for females than males. There is a significant difference in the latency of the apparent movement between the sexes. Response measures of latency and spatial displacement of autokinesis show a positive relationship. (Authors' summary)

624
Erickson, M. H.
AN INVESTIGATION OF OPTOKINETIC NYSTAGMUS. — Amer. Jour. Clinical Hypnosis, 4 (3): 181-183. Jan. 1962.

The normal person cannot inhibit optokinetic nystagmus even when made aware of its nature and coached on how to suppress it. In a series of experiments a revolving screen was used to induce optokinetic nystagmus in normal hypnotic subjects in waking and trance states. When the subjects were instructed in the trance state to develop hypnotic blindness the nystagmus slowly diminished and disappeared entirely within 5 minutes. In the waking state disappearance of nystagmus was preceded by a spontaneous trance. Also, optokinetic nystagmus was abolished during induced positive and negative visual hallucinations, regression, and in hysterical blindness. It may be made to appear without an adequate stimulus. Two patients classified as psychopathic personalities were able to suppress nystagmus while deliberately faking blindness. These findings suggest that optokinetic nystagmus can be a function of subjective perception of reality and is not reliable for use in differential diagnosis of psychogenic visual disturbances.

625
Fine, B. J., 1963
and A. Cohen
INTERNALIZATION RATIO, ACCURACY, AND VARIABILITY OF JUDGMENTS OF THE VERTICAL. — Perceptual and Motor Skills, 16 (1): 138. Feb. 1963.

Thirty-two subjects were assessed with respect to extraversion and introversion on the Internalization Ratio (IR) derived from the Minnesota Multiphasic Personality Inventory. Both groups were asked to judge the vertical with the rod starting either 85° to the left or to the right of the true vertical. Twelve out of the 18 extraverts were above median in their deviations from the true vertical. Only four of the 14 introverts and intermediates had deviations above the median. Extraverts were also characterized by higher variability of the scores.

626
Fluur, E.
THE MECHANISM OF NYSTAGMUS. —— Acta oto-laryngologica (Stockholm), 54 (2): 181-188. Feb. 1962.

In six persons with spontaneous vertical nystagmus behind closed eyes, concurrent horizontal nystagmus was induced by caloric irrigation of the horizontal semicircular canals in the vertical position. This procedure caused no change in the vertical nystagmus pattern. When the horizontal nystagmus subsided, the number of eye movements decreased, whereas the vertical nystagmus continued unchanged. The rapid phase of horizontal and vertical nystagmus invariably coincided even if the two types otherwise differed in frequency. The mechanism eliciting nystagmus is discussed, the following conclusions being drawn: (1) the slow phase of horizontal and vertical nystagmus is controlled from separate independent centers; (2) the rate of the slow phase is influenced by both peripheral and central factors; (3) the rapid phase is elicited from a center common to horizontal and vertical nystagmus; and (4) the mechanism of nystagmus is controlled from the extraocular muscle nuclei but may be affected by various centers. (Author's summary)

627
Fluur E.,
and L. Mendel
HABITUATION, EFFERENCE AND VESTIBULAR INTERPLAY: THRESHOLD AFTER HABITUATION, HABITUATION OF HORIZONTAL AND VERTICAL SEMICIRCULAR DUCTS. PRELIMINARY REPORT. —Acta oto-laryngologica (Stockholm), 56 (4): 521-522. May 1963.

The following series of experiments were performed: (1) 9 subjects underwent rotatory habituation; (2) 12 were habituated with hot water in the right ear; (3) 14 underwent rotatory clockwise habituation; (4) 12 underwent habituation of the vertical semicircular canals; and (5) 10 were habituated to downward directed nystagmus. The results showed that the habituation process both to the horizontal and the vertical semicircular canals developed in the same way irrespective of whether caloric or rotatory stimulation was used. The strength of the stimulation was of importance for the way in which habituation took place. An increase of the stimulation threshold gave a shorter nystagmus duration, while a reduction gave a longer duration.

628
Freedman, S. J.,
and D. W. Pfaff
THE EFFECT OF DICHOTIC NOISE ON AUDITORY LOCALIZATION.—Jour. Auditory Research, 2 (4): 305-309. Oct. 1962.

Discrimination of dichotic time differences was studied with twelve subjects in a constantly changing auditory field and under different conditions of motility. The three two-hour exposure conditions were (1) ambulatory with translatory and rotatory movement of head and body, (2) recumbent with no head rotation and very little body movement, and (3) passive movement in a wheel chair with head rotation and very little gross body movement. Two independent portable noise generators supplied continuous stimulation to each of the subject's ears separately. After two hours of exposure, the ambulatory subjects' ability to discriminate small time differences between the two ears was significantly impaired. Performance did not deteriorate for those whose bodily movements had been restricted under the same exposure conditions.

629
Freedman, S. J.,
and D. W. Pfaff
TRADING RELATIONS BETWEEN DICHOTIC TIME AND INTENSITY DIFFERENCES IN AUDITORY LOCALIZATION.—Jour. Auditory Research, 2 (4): 311-317. Oct. 1962.

Balancing dichotic intensity in order to center a click, after various dichotic time differences had been established, yielded an average value of 43 μsec./db. for four subjects. The same four subjects gave an average of only 23 μsec./db. when dichotic time differences were varied to center the sound, as a function of preset dichotic intensity differences. An implication of this disparity for the localization mechanisms employing dichotic time and dichotic intensity differences is discussed. (Authors' summary)

630
Gibson, J. J.,
and H. Flock
THE APPARENT DISTANCE OF MOUNTAINS. —— Amer. Jour. Psychol., 75 (3): 501-503. Sept. 1962.

The illusion of the apparent nearness of a distant summit is explained by considering the distorted optical gradient resulting from the large size of the distant shapes in comparison with closer elements, whereas usually the size of optical elements in the terrain decreases with distance.

631
Glaser, G. H.,
and D. Kennard
THE ACT OF VISUAL ATTENTION. —— Nature (London), 193 (4820): 1110. March 17, 1962.

The task of six subjects was to stare straight ahead until signaled to turn their attention to a small shot of light at a distance of 2.4 meters. In 70% of the trials there was an increase in the palpebral fissure, a decrease in the palmar skin resistance and an unaltered upper eyelid electromyogram. These results indicate that in visual tracking there is a decrease in the blinking rate, and that in visual attention there is a widening of the palpebral fissures automatically controlled by the brain.

632
Gogel, W. C.
THE EFFECT OF CONVERGENCE ON PERCEIVED SIZE AND DISTANCE. —— Jour. Psychol., 53 (2): 475-489. April 1962.

The role of absolute convergence in the perception of absolute size and distance was investigated using convergence values from 0 to 12 degrees. Perceived absolute size was measured by means of a kinesthetic adjustment. With this method, the apparent width of a binocular object of constant angular size was measured at the different convergence values. Perceived absolute distance was measured by providing a visual ruler consisting of a monocularly observed alley containing numbered rectangles. The observer judged the apparent position of the binocular object with respect to the rectangles for the values of convergence previously used with the size judgments. The results indicate that convergence was a significant contributor to perceived size and distance for some observers. However, even with the observers who showed some effect of convergence, the sensitivity in making the size and distance discriminations was low. In general, the study supports the conclusion that, even in situations in which no conflicting cues are present, absolute convergence is an imprecise and usually negligible determiner of perceived size and distance. (Author's summary and conclusions)

633
Gogel, W. C.,
E. R. Wist, and G. S. Harker
A TEST OF THE SIZE-DISTANCE INVARIANCE HYPOTHESIS. —— Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X95-25-001). Report no. 545, July 23, 1962. ii+23 p.

The size-distance invariance hypothesis states that, for an object of constant angular size, the ratio of perceived absolute size to perceived absolute distance is a constant. This hypothesis was tested using three magnitudes of effective interpupillary distance (base). Devices providing an increased, normal, or decreased base were used to view targets at 5, 10, 15, or 20 feet. Both perceived relative and perceived absolute size and distance were measured. It was found that while perceived absolute size and perceived absolute distance were related, the ratio of the two varied significantly as a function of both physical distance and base. (Authors' abstract, modified)

634
Gogel, W. C.
THE VISUAL PERCEPTION OF SIZE AND DISTANCE. —— Federal Aviation Agency. Civil Aeromedical Research Institute, Aeromedical Research Division, Oklahoma City, Oklahoma. Report no. 62-15, July 1962. 19 p.

The perception of absolute distance has been assumed to be important in the perception of the size of objects and the depth between them. A different hypothesis is proposed. It is asserted that perceived relative size and distance are the primary psychological phenomena, with perceived absolute distance derived from the perceptual summing of perceived relative depths. In agreement with this point-of-view, it is stressed that relative rather than absolute retinal extents are the determiners of visually perceived extents. A principle called the "adjacency principle" is identified as perceptually organizing the relative retinal stimuli. This principle states that the apparent size or position of any object in the field-of-view is determined by whatever size or distance cues occur between it and adjacent objects. Some evidence for the adjacency principle is discussed and some consequences of the principle are considered. (Author's abstract) (63 references)

635
Goldstein, G.
MOON ILLUSION: AN OBSERVATION. —— Science (Washington), 138 (3547): 1340-1341. Dec. 21, 1962.

Size comparisons of the moon were made from different locations by direct viewing (as opposed to comparisons by instrumental techniques). Under the proper conditions, the illusion (variable size perception) was seen while the moon's position remained essentially unaltered. By this means, evidence was adduced in favor of Ptolemy's apparent-distance hypothesis. The hypothesis concerning the moon illusion, or suggestions as to relevant factors involved, are summarized as follows: (1) the illusion depends, in some unestablished manner, upon the position of the eyes within the head; (2) it depends upon the brightness of the image on the retina; (3) it is due to differences in light refraction based upon differences in the angle of incidence to the earth's atmosphere; and (4) factors such as gravity, or the redder and therefore larger appearance of the horizon moon may be pertinent.

636
Goldstein, J.,
and C. Wiener
ON SOME RELATIONS BETWEEN THE PERCEPTION OF DEPTH AND OF MOVEMENT. —— Jour. Psychol., 55 (1): 3-21. Jan. 1963.

A series of experiments were performed using two projected disks moving simultaneously in opposite directions across a screen along parallel horizontal pathways. The results do not support Gemelli's findings that left-to-right visual movement is phenomenally faster than a simultaneous right-to-left movement when the physical speeds are equal. Other effects described pertained to phenomenal changes in speed, phenomenal depth effects, and "recoil" effects. The findings are discussed in relation to the Gestalt laws of organization, the framework as a determinant of phenomenal speed, stereokinetic phenomena, phenomenal distance, and other studies in the field of perception.

637
Gottsdanker, R.
ASSESSMENT OF MOTION AS INFLUENCED BY STRUCTURE OF BACKGROUND. —— Scandinavian Jour. Psychol. (Stockholm), 3 (2): 122-128. 1962.

Detection of target acceleration was improved by having a near landmark in addition to the surrounding frame. Adding landmarks, even within the course of motion, brought no further gain. Evidently, rate is not assessed by estimating time taken to cover known distances. Best performance was found when fine background marks were near enough together to form a texture, but not if it was perfectly uniform. It is suggested that the advantage provided both by the near point and the texture is the indirect one of stabilizing space. This effect is conceived of as graded, reaching its ultimate value in a textured surface. (Author's abstract)

638
Hanson, R. L.
MEMORY EFFECT IN SOUND LOCALIZATION [Abstract].—Jour. Acoust. Soc. America, 35 (5): 803. May 1963.

If, under free-space conditions, one listens to a real sound source at an azimuth of zero degrees, or to the image resulting from a pair of symmetrically located in-phase sources, he senses an image at or near zero degrees. If the image is shifted to one side for several seconds and then the original condition is restored, he hears an image several degrees away from the original position in a direction away from that of the side image. Various conditions that affect this image shift are discussed. (Authors' abstract)

639
Harris, C. S.,
R. K. Ambler, and F. E. Guedry
A BRIEF VESTIBULAR DISORIENTATION TEST.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1); and National Aeronautics and Space Administration, Washington, D. C. (Order no. R-47). Report no. 82, May 1, 1963. ii+10 p.

One hundred and fourteen naval aviation cadets were evaluated on their reactions to Coriolis accelerations produced by head movements in a rotating chair. Three different measures were obtained: (1) rating by four independent raters, (2) self-ratings, and (3) a Semantic Differential Form designed to measure the meaning of the experience to the subjects. Significant correlations were obtained among the raters and also among the three different measures. Thus, evidence was obtained for a reliability test and one possessing construct validity. (Authors' abstract)

640
Herrmann, R.
[DOES A CENTRAL VESTIBULAR NYSTAGMUS EXIST IN THE ABSENCE OF FUNCTIONING LABYRINTHS ON BOTH SIDES?] Gibt es einen zentral-vestibulären Nystagmus bei doppelseitig fehlender Labyrinthfunktion?—Archiv für Ohren-Nasen- und Kehlkopfheilkunde (Berlin), 181 (2): 149-153. 1963. In German.

A discussion is presented on whether or not there is a nystagmus of central vestibular origin without peripheral labyrinthine function. The author regards this as an impossibility. He argues that neither the results of the galvanic stimulation in subjects without labyrinths nor Bechterev's findings after cutting of the acoustic nerves on both sides constitute valid arguments against his hypothesis.

641
Hixson, W. C.,
and J. I. Niven
A SIGNAL CONDITIONER AND ELECTRODE TECHNIQUE FOR NYSTAGMUS MEASUREMENTS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1), and National Aeronautics and Space Administration, Washington, D. C. (NASA Order no. R-37). Report no. 78, [1963]. i+15 p.

A description is provided of an instrument which was developed to measure nystagmic eye motions produced by angular acceleration stimuli generated by a two-axis rotator and a human centrifuge. The instrument, utilizing commercially available transistorized preamplifiers, allows the simultaneous registering of horizontal and vertical nystagmic eye motions as derived from corneo-retinal potentials and operates within the high-level acceleration environment generated by the two stimuli devices. A description is also provided of the surface electrode techniques utilized in conjunction with the instrument to obtain reliable nystagmus data. (Authors' abstract)

642
Holt-Hansen, K.
OSCILLATION EXPERIENCED IN THE PERCEPTION OF FIGURES. —— Historisk-filosofiske meddelelser udgivet af det Kongelige Danske videnskabernes selskab (København), 39 (7): 1-48. June 14, 1962. In English.

Oscillations in the perception of figures presented in a series of experiments are described qualitatively and quantitatively as basis for certain classic illusions. It was possible to determine the frequency of oscillations quantitatively by a tap method and a sound method. This gave approximately 1.45 second corresponding to a frequency of 0.7 cycle per second. Exposure of figures in stroboscopic light flashing at the rate of 10.5 cycles per sec. raised the degree of oscillation though the frequency usually remained the same or increased only slightly under special conditions. Stroboscopic light flashing at frequencies above and below 10.5 cycles per second did not give optimum enforcement to the oscillations. The experienced oscillation frequency of approximately 0.7 cycle per sec. is a condition imposed apparently by function of the optical system. Although some subjects recognize the frequency as one they have experienced internally, it could not be related to pulse rate, eye movements, or head movements. The chosen stroboscopic flash frequency of 10.5 cycles per second which had an optimum effect on the oscillations is of the same magnitude as the alpha rhythm.

643
Jonkers, G. H.,
and P. H. Kylstra
BRIGHTNESS CONTRAST AND COLOUR CONTRAST IN STEREOSCOPIC VISION ACUITY.—Ophthalmologica (Basel), 145 (2): 139-143. 1963. In English.

In a series of experiments on four subjects, binocular stereoscopic acuity under conditions of color contrast with low brightness contrast was inferior to acuity under conditions of high brightness contrast. This attests to the more important role of brightness contrast in depth perception as compared to color contrast. (Authors' summary, modified)

644
Julesz, B.
VISUAL PATTERN DISCRIMINATION. — IRE Trans. on Information Theory, IT-8 (2): 84-92. Feb. 1962.

Visual discrimination experiments were conducted using unfamiliar displays generated by a digital computer. The displays contained two side-by-side fields with different statistical, topological or heuristic properties. Discrimination was defined as that spontaneous visual process which gives the immediate impression of two distinct fields. The condition for such discrimination was found to be based primarily on clusters or lines formed by proximate points of uniform brightness. A similar rule of connectivity with hue replacing brightness was obtained by using varicolored dots of equal subjective brightness. The limitations in discriminating complex line structures were also investigated. Physiological models for connectivity detection are suggested in terms of spatial interaction of simple excitation and inhibition followed by nonlinear slicing. These experiments also support recent neurophysiological evidence of complex spatial interactions in the higher visual centers whereby specific neurons respond selectively to various properties such as curvature, angles, etc. (Author's summary, modified)

645
Klemmer, E. T.
PERCEPTION OF LINEAR DOT PATTERNS.—Jour. Exper. Psychol., 65 (5): 468-473. May 1963.

Linear dot patterns were presented tachistoscopically by flashing randomly selected patterns on uniformly spaced light bulbs. The total visual angle was varied from 2.5° to 160° using 21 bulbs and, in a separate experiment, number of bulbs was varied from 11 to 35, using a fixed 1° spacing between bulbs. Perception was determined by a poststimulus cue requiring only a 1-bit response. Average accuracy of report was surprisingly insensitive to visual angle. The center bulbs were seen better than the end bulbs at all visual angles. When the spacing of bulbs was fixed at 1° and the number of bulbs increased from 11 to 35 the percent-error increased linearly with near perfect performance for 11 bulbs (poststimulus cue method). Comparison with previously reported data on the perception of linear dot patterns indicates that the earlier findings may have been due to memory rather than perception. (Author's summary)

646
Korolenok, K. Kh.,
and B. A. Iakubov
[ON SOME DISORDERS OF SPATIAL ORIENTATION IN PILOTS DURING FLIGHT] O nekotorykh vidakh narushenii prostranstvennoi orientirovki u pilotov v protsesse letnoi deiatel'nosti.—Voprosy psikhologii, 8 (6): 63-68. Nov.-Dec. 1962. In Russian, with English summary (p. 68).

A total of 184 cases of spatial disorientation were studied in the years 1944-60. 58.7% of these were attributed to elementary illusions, i.e., illusions caused only by one factor such as banking, turn, gliding etc. Complex illusions, consisting of subjective sensations evoked by more than one factor, accounted for 3.3% of the cases. Failure of perceptual response to the linear motion of aircraft was registered in 7.6%, and inversion illusion in 8.7% of the cases. The coordination illusion was noted in 4.3% of the cases, and usually resulted in bailout. Tropical illusions occurred in only 17.4% of the cases, with 4.9% falling into paragnostic, and 12.5% into agnostic categories. The illusions of coordination and orientation result most frequently during the flight in clouds or at night, while spatial disorientation occurs as a result of post-influenza asthenia, after alcoholic or drug intoxication, and after emotional conflicts.

647
Mackensen, G.,
and U. Rudolph
[INVESTIGATIONS OF THE PHYSIOLOGY OF THE OPTOKINETIC AFTER-NYSTAGMUS. III. A CONTRIBUTION ON THE ORIGIN OF THE OPTOKINETIC AFTER-NYSTAGMUS] Untersuchungen zur Physiologie des optokinetischen Nachnystagmus. III. Beitrag zur Entstehung des optokinetischen Nachnystagmus. — Albrecht von Graefes Archiv fur Ophthalmologie (Berlin), 165 (1): 60-70. 1962. In German.

The course of the optokinetic after-nystagmus was studied in twenty healthy subjects after nystagmus and after inhibition of the initial nystagmus. All subjects exhibited an after-nystagmus following optokinetic nystagmus. Fixation on a stationary point during the stimulation inhibited the optokinetic nystagmus. However, as a result of the optokinetic stimulation alone without the initial nystagmus, optokinetic after-nystagmus in both directions appeared in seven subjects; optokinetic after-nystagmus in one direction only appeared in eight subjects; and there was none in five subjects. Following inhibition the optokinetic after-nystagmus had a lower frequency, lower amplitude, and wide irregularities in its course. Its termination was often difficult to discern. A reversal in the direction of jumps was observed also after inhibition of the primary nystagmus. (Authors' summary, modified)

648
Miller, E. F.,
and A. Graybiel
ROTARY AUTOKINESIS AND DISPLACEMENT OF THE VISUAL HORIZONTAL ASSOCIATED WITH HEAD (BODY) POSITION.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1), and National Aeronautics and Space Administration, Washington, D. C. (NASA Order no. R-47). Report no. 77, March 5, 1963. ii+10 p.

Continuous settings to the visual horizontal by the authors and two experienced test pilots were recorded during a 23-minute period. The background to the luminous line target was alternately illuminated for 2 minutes then darkened completely for 5 minutes. All subjects performed in a similar and highly reliable manner, but the pilots manifested significantly less total error. In an upright position, the accurate and relatively stable perception of the horizontal was not appreciably influenced by the lack of visual cues; in a recumbent position, removal of these cues caused, after a brief lag period, a gradual spontaneous rotation of the phenomenal horizontal up to the maximum typical for each subject. In addition, there was considerable fluctuant movement described as rotary autokinesis. These illusions disappeared almost instantaneously when the background was illuminated. Prolonged observation (30 minutes) of the target in the dark while recumbent resulted in a significant decrease in the illusion for one of the author subjects. (Authors' abstract)

649
Miller, E. F.,
and A. Graybiel
ROLE OF THE OTOLITH ORGANS IN THE PERCEPTION OF HORIZONTALITY.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1); and National Aeronautics and Space Administration, Washington, D. C. (Order no. R-37). Report no. 80, March 19, 1963. ii+19 p.

When visual background cues were present, settings of a luminous line target to the horizontal in the upright, recumbent, and inverted positions were quite accurate in both the normal and labyrinthine-defective (L-D) subjects. Removal of empirical visual cues revealed that all subjects were qualitatively similar; quantitatively, however, there were significant intergroup differences. When upright, the normals were able on the average to maintain their accuracy while the L-D subjects deviated significantly in their settings. Both groups of subjects in the recumbent position perceived the Aubert illusion, but the magnitude of the illusion was considerably less in the normal group. When inverted, no significant intergroup difference was found. The intergroup perceptual differences were best explained as an effect of loss of otolith function in the L-D subjects. It was concluded that the otolith organs in man act directly or indirectly to increase his accuracy in egocentric visual localization at least in the upright and recumbent positions. (Authors' abstract) (27 references)

650
Morinaga, S.,
K. Noguchi, and A. Ohishi
THE HORIZONTAL-VERTICAL ILLUSION AND THE RELATION OF SPATIAL AND RETINAL ORIENTATIONS. — Japanese Psychol. Research (Tokyo), 4 (1): 25-29. April 1962. In English.

The vertical extension of a figure appears to the observer to be longer than an equal figure extending horizontally. As a part of studies on the inhomogeneous nature of the visual space, an attempt was made to investigate whether or not, or to what extent, the change in the relation between spatial and retinal orientations influenced the amount of illusion in the L-shaped figure and its modifications. The conditions were: (I) the figure was tilted to the right, the subject's head was held upright; (II) the head was tilted to the right (A) or to the left (B), but the figure was held upright; and (III) both figure and head were tilted to the right at the same time. The change in orientation of figures was found to affect the amount of illusion, most markedly in Condition I, less markedly in Condition II, and slightly in Condition III. It was concluded that the retinal factor is of the primary importance, though not exclusive, in producing the horizontal-vertical illusion. (Authors' summary)

651
Natsoulas T.
ON HOMOGENEOUS RETINAL STIMULATION AND THE PERCEPTION OF DEPTH.—Psychological Bull., 60 (4): 385-390. July 1963.

A review of recent experiments showing that where the perception of voluminous fog does not occur consistently under conditions attempting homogeneity of visual stimulation, there are sources of inhomogeneity which can produce the impression of a surface. As homogeneity is approached, the voulme experience becomes more reliable. A view of this phenomenon, other than Gibson's (which does not deal with it on the grounds of poor reliability) or Koffka's (which attributes it to the fundamental nature of the perceptual system), is presented. It is based on kinesthetic stimulation as a likely source of visual space anisotropy with respect to perceived distance. (Author's summary)

652
Naylor, G. F. K.
EFFECTS OF STRESS ON THE PERCEPTION OF DIRECTION.—Australian Jour. Psychol. (Melbourne), 15 (1): 17-28. April 1963.

A series of experiments was conducted in which subjects made personally controlled judgments of the vertical or horizontal under non-stressed and stressed conditions. Stress was produced mainly by auditory and muscular stimulation, applied in some instances asymmetrically and in others symmetrically. Stress produced by visual, gustatory, and emotional stimulation was also employed. Judgments of the vertical were made by both visual and non-visual (tactile-kinesthetic) methods. The results indicate (a) that judgments made without extraneous stress differ significantly from those made under stressed conditions; (b) that the subjective vertical of each individual tends to be displaced in the same direction by stresses applied to either side of the body or in a symmetrical manner; (c) that this effect occurs when the vision used for judgment is monocular as well as binocular; (d) that there is significant correlation between the vector-magnitudes of deflections associated with stresses of different kinds. (Author's summary)

653
Neverov, V. V.
[PROLONGED REVERSIBLE POSTOPTOKINETIC NYSTAGMUS] Dlitel'nyi reversivnyi postoptokineticheskii nistagm.—Doklady Akademii nauk SSSR (Moskva), 150 (5): 1182-1184. 1963. In Russian.

Optokinetic stimulation of rabbits for 60 to 90 minutes produced no statistically certain increases in the amplitude of the eye movements in 4 out of 5 animals, however, their frequency was reduced. When stimulation ceased, reversible postoptokinetic nystagmus developed with its rapid phase directed away from optokinetic nystagmus. The postoptokinetic nystagmus appeared 10-130 seconds after cessation of stimulation, lasted on the average 35,5 to 46,4 minutes, and gradually disappeared.

654
Ogle, K. N.
THE VISUAL SPACE SENSE. — Science, 135 (3506): 763-771. March 9, 1962.

A presentation is given of the basic, modern concepts of the visual perception of space. Various approaches to the problem are discussed. Basic phenomena are reviewed including figure discrimination, perception of relative visual direction, and externalization of perceived objects. Object location, and empirical factors affecting distance and depth perception are discussed. Factors such as sensation of air space, binocular vision, and number of objects are given in relation to depth perception. Experiments for measuring depth perception without secondary cues to spatial localization, and for testing the effect of disparate stimuli on depth perception are presented. The theory that accommodation and convergence give stimulation to spatial localization of objects is discussed, and the role of proprioceptive sensation in space perception is debated. The hypothesis that perceptual space in stereoscopic vision is a priori three-dimensional is discussed as well as other geometrical aspects of visual space.

655
Panian, Z.
[VISUAL ILLUSIONS DURING FLIGHT] Vizuelne iluzije za vrijeme letenja.—Vojnosanitetski pregled (Beograd), 19 (12): 832-836. Dec. 1962. In Serbo-Croatian.

Visual illusions during flight, which interfere with spatial orientation, are reviewed. The physical factors of visual perception are: the intensity of the light energy, changes (intermittency, movement) of the light source, color, distance, position, and size of the source of light. In addition to these parameters, the interpretation of a visual stimulus depends on cerebral or psychological factors: memory, experience, perspective, and combinations with other sensory input (olfactory, acoustic, proprioceptive, etc.). The physiological state of the visual system is likewise to be considered. Common visual illusions occurring during flight are discussed: autokinetic illusions (may be reduced or suppressed by avoiding the prolonged fixating of an isolated object and by frequent blinking), illusion of the false horizon (observed in flying among inclined cloud layers), illusory motion perception, faulty estimation of size, distance, and velocity, and complex perceptual phenomena (oculogyral and oculogravic illusions). Pilots must familiarize themselves with these illusions during their training.

656
Pignataro, O.,
and F. Dittrich
[A COMPARATIVE STATISTICAL STUDY OF THE POST-ROTATORY SENSATIONS AND NYSTAGMUS] Etude statistique comparative de la sensation et du nystagmus post-rotatoires.—Practica oto-rhino-laryngologica (Basel), 25 (1): 33-43. 1963. In French, with English summary (p. 43).

Statistical comparison between post-rotation nystagmus and sensations is useful for the understanding and clinical evaluation of responses to rotation tests. The authors therefore carried out personal studies on 23 different normal subjects. These were divided into three groups to evaluate (1) the duration of post-rotation nystagmus alone; (2) the duration of post-rotation sensations alone; and (3) the duration of post-rotation nystagmus and sensations together. (Authors' summary)

657
Pollack, R. H.
APPLICATION OF THE SENSORY TONIC THEORY OF PERCEPTION TO FIGURAL AFTEREFFECT. —Acta psychologica (Amsterdam), 21: 1-16. Feb. 1963.

Contemporary theoretical viewpoints on figural aftereffects are reviewed and rejected because of their inadequate treatment of figural aftereffect data and their lact of systematic integration of these with other perceptual phenomena. A type of adaptation theory is proposed, namely, the sensory-tonic field theory of perception. Experimental application of this theory to the prediction of the direction and magnitude of figural aftereffect displacements has met with success. The author concludes that although the success of the theory is limited, there appears to be hope for its extension.

658
Ranney, J. E.,
and S. H. Bartely
A FURTHER STUDY OF DETERMINANTS OF PHENOMENAL DISTANCE IN PLANE TARGETS PERCEIVED AS THREE-DIMENSIONAL SCENES. —Jour. Psychol., 56 (1): 19-27. July 1963.

This study investigated the effects of item position, item size, and location of a large background item, on the phenomenal distance of an item in a photographed scene. Twelve observers compared eight large variable targets to two smaller, fixed targets, matching them so that the crucial items in the photographs appeared to be the same distance from the observer. The variable targets were photographs of an asymmetrical artificial scene containing either a small or large item to the left or right of center, and mirror images of these prints. In the standard targets the small item was in the center of the scene. The results led to the following conclusions: (1) Large items appear nearer than small items located at the same position in the photographs. (2) The position of a large background item is important in determining the phenomenal distance of the crucial item; it is more important where the crucial item is small, less important when it is large. (3) The item on the left appears nearer than the one on the right when the large background item is on the right. (Authors' summary)

659
Rapoport, J.
MASSED PRACTICE AND MOTION AFTER-EFFECT.—Perceptual and Motor Skills, 17 (1): 157-158. Aug. 1963.

No significant change in the duration of motion after-effect was found in 20 massed trials using a rotating windmill stimulus pattern. However, there was a reliable tendency for each subject who repeated his performance on two separate days, either to shorten or to lengthen the after-effect during the session. (Author's summary)

660
Roman, J. A.,
B. H. Warren, and A. Graybiel
OBSERVATION OF THE ELEVATOR ILLUSION DURING SUBGRAVITY PRECEDED BY NEGATIVE ACCELERATIONS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1); and School of Aerospace Medicine, Brooks Air Force Base, Tex. (Report no. SAM-TDR-62-141). Report no. 83, May 15, 1963. iii+8 p.

By observing apparent displacements of a real target, and visual afterimages during weightlessness preceded by positive or negative acceleration, it was possible to identify these displacements as a special case of the elevator illusion (change in magnitude of the resultant force only) as opposed to the oculogravic illusion (change in angle phi). Positive and negative linear acceleration, as well as weightlessness, was obtained for this purpose in jet aircraft. (Authors' abstract)

661
Rossberg, G.
[EXPERIMENTALLY INDUCED VESTIBULAR NYSTAGMUS AND CENTRAL COORDINATION]
Experimentell-vestibulärer Nystagmus und zentrale. —Archiv für Ohren- Nasen- und Kehlkopfheilkunde (Berlin), 179 (6): 567-593. 1962. In German.

Experiments with caloric nystagmus in different positions of the head in space yielded results which cannot be explained on a purely mechanical-mathematical basis. The optimum position of the horizontal semicircular canal is not always identical with the maximum reaction which appears in different planes due to individual variations in the labyrinth structure within the skull. In addition to the optimum, there appears close to the pessimum a secondary maximum which is dependent upon the excitation of the vertical semicircular canals. Structural variation of the arrangement of the semicircular canals in the skull and the influence from the excitation of the otoliths alter the vestibular reaction in regard to certain essential characteristics. The structural deviations of the labyrinth and the function of otoliths are discussed in detail. The interpretation of the experimental results considers the central nervous processes in addition to the peripheral processes. The central evaluation of the centripetal stimuli probably occurs within the reticular formation or higher regions up to the thalamus rather than within the vestibular nuclei near the fourth ventricle. Numerous incoming stimuli within the reticular formation determine the nystagmic process both qualitatively and quantitatively. (84 references)

662
Schubert, G.,
and H. Kolder
FACTOR ANALYSIS OF SPACE ORIENTATION. —— Rivista di medicina aeronautica e spaziale (Roma), 25 (1): 64-86. Jan.-March 1962. In English.

Information from the visual system sufficed to set the apparent vertical according to visual clues in four persons exposed to radial accelerations on a centrifuge of 2.5 g. At 3 g, space orientation according to visual clues was more difficult. Without visual clues, information originating in the otolithic organs improved perception of resultant acceleration proportionally to the degree of tilting of the longitudinal axis of the head toward the direction of resultant acceleration. Information from somesthetic receptors did not interact with perception of the direction of resultant acceleration mediated by labyrinthine receptors, as long as the direction of acceleration acting on them was oblique. The change in perception of the apparent vertical with head tilting was different when the direction of the longitudinal axis of the body coincided with the direction of the resultant acceleration without visual clues. Information from somesthetic receptors, acted upon in the "normal" direction, suppressed to a certain degree additional information from the otoliths. There was no further improvement of the setting of the apparent vertical unless the longitudinal axis of the head was placed about 10 degrees toward the direction of the resultant acceleration.

663
Smith, Sidney L.
ANGULAR ESTIMATION. —— Jour. Applied Psychol., 46 (4): 240-246. Aug. 1962.

In one study, ten subjects estimated the directional trend (heading) of simulated radar trails, using different response modes; rotary switch adjustment permitted better accuracy than numerical estimation. Varying the displayed length of the simulated trails from 5/16 to 1 1/2 inches had no apparent effect on estimation accuracy. Five civilian subjects proved more accurate than five airmen. In a second study, 20 subjects estimated the angular position of lines varying in length from 1/8 to 1 inch, using equipment which permitted switch adjustment and numerical estimation only to the nearest 10 degrees. Results were the same as before. In addition, this report notes differences in estimation accuracy and bias related to the actual angle of displayed lines over a 360-degree range, as well as biasing effects of right- versus left-handed switch adjustment. (Author's summary)

664
Spigel, I. M.
AUTOKINETIC MOVEMENT OF AN INTERMITTENT LUMINANCE.—Psychol. Record, 13 (2): 149-153. April 1963.

The effects of intermittence on the autokinetic movement of a "point" source of luminance were explored at five flash rates and two levels of brightness with 40 naive subjects. While generally more movement was recorded for the less bright stimulus, the relation of amount of movement to flash rate was curvilinear, with peak movement observed in the 10 c.p.s. range. The apparent incongruity of this determination with the expectation of less movement in the "brightness enhancement" range was noted, as was the problem of attributing autokinetic movement to redundancy in the visual world. (Author's abstract)

665
Stedman, W. C.,
and C. A. Baker
PERCEIVED MOVEMENT IN DEPTH AS A FUNCTION OF STIMULUS SIZE.—Human Factors, 4 (6): 349-354. Dec. 1962.

The ability of subjects to perceive movement in depth of flat, circular luminous objects of various angular subtenses in an otherwise stimulus-free field was studied. The stimulus object has a luminance of 1 ft.-Lambert and varied in angular size from 1.5 to 60' of arc at the onset of movement. A method of constant stimuli was used to determine threshold values for the perception of movement. Accuracy in reporting direction of movement improved as the angular subtense of the stimulus increased. For stimuli with subtenses of 1.5 and 60' of arc the 75% thresholds of perceived movement were 8 and 2% change in angular size, respectively. A break in this function was found in the vicinity of stimulus sizes of 12' of arc which indicates the possibility of two mechanisms involved in perceiving movement in depth. (Authors' abstract)

666
Suzuki, J. I.,
and A. Komatsuzaki
CLINICAL APPLICATION OF OPTOKINETIC NYSTAGMUS: OPTOKINETIC PATTERN TEST. — Acta oto-laryngologica (Stockholm), 54 (1): 49-55. Jan. 1962.

Optokinetic nystagmus was provoked by constant acceleration followed by constant deceleration of an electrically controlled rotating drum. Nystagmus thus induced was recorded on a chart fed at the speed of 0.1 cm./sec. Two-channel electronystagmography was used with time constants of 6 seconds and 0.015 seconds in order to approximate the former to eye deviation and the latter to eye speed. Eye speed of the slow-phase-induced nystagmus in normals increases and decreases in close approximation to the angular speed of the drum. The patterns obtained were denominated "optokinetic pattern" (OKP), and the procedure "OKP test". OKP was modified by a weak spontaneous vestibular nystagmus in proportion to its degree. When optokinetic stimulation was applied to spontaneous nystagmus of ocular or central origin, OKP appeared to show characteristic patterns according to causative lesions. An analysis of these patterns, therefore, is expected to contribute to differentiation and identification of spontaneous nystagmus. (Authors' summary)

667
Taylor, M. M.
FIGURAL AFTER-EFFECTS: A PSYCHOPHYSICAL THEORY OF THE DISPLACEMENT EFFECT.— Canad. Jour. Psychol., 16 (4): 247-277. Dec. 1962. (DRML Project no. 250)

The class of phenomena known as "figural aftereffects" is described in terms of a neutralization effect in which steadily viewed figures tend toward "norms", and a displacement effect in which test figures tend to be displaced away from an inspected figure. A psychophysical theory of the displacement effect is presented, based on the assumption that perceived distance is a monotonic increasing function of discriminability, other things being equal. Discriminability cannot be measured by the summation of just noticeable differences. An anchor was supposed to displace other points away from its neighbourhood, if it did not enter into confusion with preexisting points. This theory is used to predict the "filled space illusion", "distance paradox", etc. (Author's summary, modified) (93 references)

668
Taylor, M. M.
THE DISTANCE PARADOX OF THE FIGURAL AFTER-EFFECT IN AUDITORY LOCALIZATION.— Canad. Jour. Psychol., 16 (4): 278-282. Dec. 1962. (DRML Report No. 250-2.)

The displacement of the perceived position of one noise source by another was measured, under conditions like those of studies on figural after-effects. The distance paradox was obtained, as had been predicted by Krauskopf (1954) on the basis of partial results. The numerical results agreed closely with those of Krauskopf in the range common to both studies. It is elsewhere shown that the results also agree numerically with results from studies in different modalities. (Author's summary)

669
Terwilliger, R. F.
EVIDENCE FOR A RELATIONSHIP BETWEEN FIGURAL AFTER-EFFECTS AND AFTER-IMAGES.—Amer. Jour. Psychol., 76 (2): 306-310. June 1963.

Evidence is presented which is relevant to the problem of figural after-effects (FAE), and in particular to those size-distortions studied by Köhler and Wallach. Previous results have indicated that these size-distortions follow a law of visual angle in the same way that after-images follow Emmert's law, also a law of visual angle. The present studies show that both phenomena are subject to interocular transfer and that they both continue to follow a law of visual angle when transferred. The results suggest that these two phenomena may be quite closely related. Köhler and Wallach's rejection of a theory of FAE based on retinal fatigue or after-images on the ground that after-images do not show interocular transfer is totally invalid. Such transfer does take place, and thus FAE could be explained retinally. Such a state of affairs has not been proven, but it is worth considering. (Author's summary and conclusions)

670
Wallach, H.,
and C. Zuckerman
THE CONSTANCY OF STEREOSCOPIC DEPTH.— Amer. Jour. Psychol., 76 (3): 404-412. Sept. 1963.

The constancy problem in stereoscopically perceived depth or more precisely the relation between perceived depth and the distance of the depth-interval from the eyes is analyzed. The problem of stereoscopic depth constancy is compared to the problem of size-constancy with respect to underlying causal processes. Supporting experimental work deals with (a) the behavior of the anaglyph, (b) the perspective-cues in stereoscopic depth-constancy, and (c) the effect of optical magnification.

671
Wallach, H.,
and E. B. Karsh
WHY THE MODIFICATION OF STEREOSCOPIC DEPTH-PERCEPTION IS SO RAPID.—Amer. Jour. Psychol., 76 (3): 413-420. Sept. 1963.

Two possible explanations for the rapidity with which a modification of stereoscopic depth-perception can be achieved have been tested. One assumes that veridical stereoscopic vision is based on a somewhat unstable learning product which must be reacquired continuously on the learning occasions which occur in normal use of binocular vision. Evidence was found for the deterioration of stereoscopic depth-perception after 24 hours of monocular vision, but the connection between the effect of disuse and the effectiveness of training could not be established. The other explanation assumes that the training procedure is so effective in changing the product of previous learning of stereoscopic vision because it provided a high concentration of learning occasions as compared to such occasions in ordinary life. Experimental testing of this assumption suggests that a high concentration of learning occasions is not the sole explanation for the rapidity with which a modification of depth-perception is obtained. To a great extent, this rapidity seems to depend on an inherent modifiability of stereoscopic depth-perception, and the evidence for its fast deterioration supports this view. (Authors' summary and conclusions, modified)

672
Wallach, H.,
and E. B. Karsh
THE MODIFICATION OF STEREOSCOPIC DEPTH-PERCEPTION AND THE KINETIC DEPTH-EFFECT. —Amer. Jour. Psychol., 76 (3): 429-435. Sept. 1963.

Casual processes in the rapid modification of stereoscopic depth-perception by viewing a rotating three-dimensional wire-form through a telestereoscope are discussed. Experimental evidence reveals that a significant training effect is achieved only by providing the conditions for stimulation of the kinetic depth-effect.

673
Wiener, E. L.
MOTION PREDICTION AS A FUNCTION OF TARGET SPEED AND DURATION OF PRESENTATION. — Jour. Applied Psychol., 46 (6): 420-424. Dec. 1962.

This study investigated the ability of subjects to predict the future position of a moving target after the target disappeared. Target speed, duration of target exposure, and subject's mode of responding to the visible target were varied. The performance measure was the absolute deviation from the correct target position at the end of 9 seconds, converted to error relative to target speed. Results show: (a) no significant differences resulting from mode of response (tracking vs. monitoring), order of presentation, duration of presentation, or speed-duration interaction; (b) significant learning effect from session to session ($p < .01$); and (c) an increase in relative error, in an inverse relation to target speed ($p < .01$). It is concluded that a human operator may be able to make motion predictions equally as well with minimal as with maximal exposure to target input; only target speed exerts an influence on prediction accuracy. (Author's summary)

f. Psychomotor and Neuromuscular Performance and Responses (Including Reaction Time)

674
Adams, J. A.,
and R. W. Chambers
RESPONSE TO SIMULTANEOUS STIMULATION OF TWO SENSE MODALITIES. — Jour. Exper. Psychol., 63 (2): 198-206. Feb. 1962.

An experiment was performed to answer the question of whether a human subject could do two things at once without impairment. A bisensory discrete tracking task was used where a probabilistic series of simultaneous auditory and visual stimuli were presented, each stimulus series for response with a separate hand. An auditory and a visual control group each practiced only a unisensory version of the task where response was with one hand. All events were of 2-sec. duration and had time certainty, but the type of event occurring next in the series could be either certain or uncertain. The results revealed a net superiority of bisensory over unisensory responding when stimulus events were certain. This was because the subject in the bisensory task usually made the two response movements together, and anticipation of certain events resulted in an increase in speed of the visual response time to that of the faster audio response time. But, when events were uncertain, impairment was inferred for bisensory responding because the faster audio response time was reduced in speed and synchronized with the slower visual response time. (Authors' summary)

675
Adams, J. A.,
and L. R. Creamer
PROPRIOCEPTION VARIABLES AS DETERMINERS OF ANTICIPATORY TIMING BEHAVIOR.— Human Factors, 4 (4): 217-222. Aug. 1962.

Anticipatory timing, where the human operator initiates an accurate response before the actual occurrence of the environmental event, is one of the most striking and least studied aspects of skilled motor performance. An experiment was performed on temporal and control system variables that could influence the timing of responses in a tracking task. Verification was sought for a proprioceptive trace hypothesis that holds the time-varying proprioceptive after-effects of movements to be the internal trace that persists in time and cues the occurrence of a future response. Ninety-six subjects participated. A 2 x 2 x 2 randomized factorial design used two values each of movement amplitude, spring loading, and signal duration as a means of manipulating proprioceptive stimuli and their time trace. Results supported the hypothesis. Signal duration and spring loading of

676
Adams, J. A.
TEST OF THE HYPOTHESIS OF PSYCHOLOGICAL REFRACTORY PERIOD. —— Jour. Exper. Psychol., 64 (3): 280-287. Sept. 1962.

An experiment involving a two-dimensional, bisensory discrete tracking task was performed to test two hypotheses (the expectancy hypothesis and the central decision-time hypothesis) on the psychological refractory period, i.e., the decrement in response to the second of two closely spaced stimuli. The results supported the expectancy hypothesis which ascribes decrement to the subject's past experience with the random array of interstimulus intervals. Through practice the subject comes to expect a longer delay and the decrement occurs because he is not optimally ready to respond. Reliably less decrement was found in subjects who trained on a stimulus series with a predominance of small time intervals and could learn behavior appropriate to them. (Author's summary, modified)

677
Adams, J. A.,
and C. E. Webber
MONTE CARLO MODEL OF TRACKING BEHAVIOR. —Human Factors, 5 (1): 81-102. Feb. 1963.

A Monte Carlo model was devised for simulation of human tracking behavior with a digital computer. The model had four basic equations and included provision for one- and two-dimensional tracking, repetitive and irregular input signals, and practice trials. Four groups of 12 human subjects each were given 40 practice trials on either one- or two-dimensional tracking, and either repetitive or irregular input signals. The model was then used to simulate corresponding data for four groups of 12 hypothetical subjects each, and comparisons of the real and hypothetical subject samples were made for various measures of proficiency. Overall, the adequacy of the simulation was judged as good. Research tactics are discussed for arriving at a generalized model of n-dimensional tracking behavior, and for elaborated models that will include procedural and decision acts to simulate more complex man-machine systems. (Authors' summary)

678
Antonov, V. N.,
V. V. Lepeshkin, and A. E. Ol'shannikova
[EXPERIMENTAL DEVICE FOR THE STUDY OF THE EFFECTS OF VARIOUS PARAMETERS OF VISUAL SIGNALS ON THE EFFICIENCY OF MOTOR REACTIONS] Eksperimental'naia ustanovka dlia izucheniia vliianiia razlichnykh parametrov zritel'noi signalizatsii na effektivnost' dvigatel'noi reaktsii.— Voprosy psikhologii (Moskva), 9 (3): 134-136. May-June 1963. In Russian.

A device is described which was designed to study the effects of visual stimulation upon motor reaction time and the correlations between time parameters of motor reactions and their quantitative aspects. The apparatus could be used in the analysis of comparative effects of different visual stimuli such as exposure to different figures, lettering, geometric angles, and straight lines.

679
Bartlett, N. R.
A COMPARISON OF MANUAL REACTION TIMES AS MEASURED BY THREE SENSITIVE INDICES. —— Psychol. Record, 13 (1): 51-56. Jan. 1963.

Visual reaction time data for each of three subjects are analyzed to show by how much the response as recorded by a sensitive microswitch, closed by forearm movement, lags behind the initial application of pressure, as recorded by a strain-gauge device, and in turn by how much the latter falls behind the muscle action potential. The data afford rough corrections for translating typical reaction time data to those concerned with the initiation of the peripheral effector response. (Author's summary)

680
Bartz, A. E.
EYE-MOVEMENT LATENCY, DURATION, AND RESPONSE TIME AS A FUNCTION OF ANGULAR DISPLACEMENT. —— Jour. Exper. Psychol., 64 (3): 318-324. Sept. 1962.

The present research had two purposes: (a) to determine the speed of seeing in a complex visual task and (b) to isolate and measure the various components of the total response (initial latency, travel time of the eye, and the response time for interpreting the signal). Results of Experiment (a) showed that reaction time increased as the visual angle from the center line of regard increased. There was no significant difference between pairs of means for right and left sides. It was also found that response time increased as the number of possible signals increased. In Experiment (b) the time required for each of the three components of the response increased as the angle increased. Several interpretations of the positive relationship between angle and the time required for the subject to make his vocal response after his eyes had reached the signal were considered. (Author's summary)

681
Bekey, G. A.
THE HUMAN OPERATOR AS A SAMPLED-DATA SYSTEM. —— IRE Trans. on Human Factors in Electronics, HFE-3 (2): 43-51. Sept. 1962.

A sampled-data model of the human operator in compensatory tracking is proposed. The model assumes that the operator's behavior is characterized by sampling, data reconstruction, and extrapolation operations. An experimental program conducted to evaluate certain implications of the new model measured the power spectral density of the tracking error under a variety of conditions. The experimental results indicate that for inputs of sufficiently high bandwidth, the output and error spectra of human operators are characterized by sharp peaks which occur in the range of 1-1.5 c.p.s. The correspondence of these spectral peaks to those produced by the mathematical model is discussed. Some preliminary results obtained while tracking with an intermittent display are evaluated on the basis of the model. (Author's summary, modified)

682
Belleville, R. E.,
F. H. Rohles, M. E. Grunzke, and F. C. Clark
DEVELOPMENT OF A COMPLEX MULTIPLE SCHEDULE IN THE CHIMPANZEE.—Jour. Exper. Analysis Behavior, 6 (4): 549-556. Oct. 1963.

The development of chimpanzee behavior on a four-component, three-lever multiple schedule is described. Component schedules included the Sidman avoidance procedure with a concurrent discriminated avoidance schedule on a second lever, fixed ratio performance for food, differential reinforcement of low rate for water requiring a dual response chain, and a symbol discrimination task for continuous food reinforcement using three levers. The avoidance component of this schedule was employed during the January 31, 1961, suborbital space flight of the chimpanzee "Ham." On November 29, 1961, the chimpanzee "Enos" performed on the multiple schedule during three orbits around the earth in a Mercury capsule. (Authors' summary)

683
Botwinick, J.,
and J. E. Brinley
AN ANALYSIS OF SET IN RELATION TO REACTION TIME. — Jour. Exper. Psychol., 63 (6): 568-574. June 1962.

Principal component analyses were performed with reaction times (RTs) in relation to preparatory intervals (PIs) in six different series. Components of general RT level or RT set were found on which all PIs loaded substantially. In addition, short-interval components were found when matrices were rotated orthogonally. Long-interval components were not found, nor were other identifiable components. The results are discussed in relation to the hypothesis that aspects of RT set were distinguishable, different in meaning, and independent. RTs were related to both the PI and its specific context. While RT level was different for auditory and visual stimulation, the difference was not related to PI or its context. Thus, set, as inferred from the relation between RT and PI, was independent of sense modality. (Authors' summary)

684
Břicháček, V.
[RELATION BETWEEN DIRECTION AND SPEED OF MOTION] Vztah mezi směrem a rychlostí pohybu při kontinuitní činnosti. — Československá psychologie (Praha), 6 (1): 36-46. 1962. In Czech, with English summary (p. 46).

An experiment was carried out concerning the relation between the direction and the speed of motion. In front of the subject was placed a signal board with 12 light bulbs arranged in a circle and marked by numbers 1-12 clockwise. Each bulb had a button. The stimuli lighted up in the sequence determined by the experimenter. The subject reacted to the stimulus by pressing the corresponding button, thus also lighting up the next bulb. The reactions were registered automatically on the electrochronograph. The work was carried out alternately by the right and left hand. The reactions in straight directions were found to be quicker than reactions in oblique lines. Motions in direct lines are probably performed better because they are used more frequently. The quickest reaction was from left to right; the slowest reactions were from below upwards and those away from the subject. When the signal board was in an oblique position, the speed of the reaction was slower than when it was in a horizontal or vertical position; this may be due to poorer visibility. No great differences were found between the work of the right and left hand. On the basis of the results preliminary conditions were drawn concerning the construction of control and instrument panels. (Author's summary, modified)

685
Briggs, G. E.
PURSUIT AND COMPENSATORY MODES OF INFORMATION DISPLAY: A REVIEW. — Ohio State Univ., Columbus (Contract AF 33(616)-6107); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7183, Task no. 718306). Technical Documentary Report no. AMRL-TDR-62-93, Aug. 1962. iv+13 p.

A review is presented of the literature on pursuit display versus compensatory display for continuous control (tracking) tasks. It covers published research on this topic to October 1961 and includes only those studies which compared the two display modes. The pursuit mode is preferable under most of the experimental conditions studied. However, the choice of a particular mode must be made in the light of the kind of information required by subjects in a particular control system. Thus, if it is necessary for the subject to use higher derivatives of the input signal in determining his motor output, a pursuit-type display is indicated as it most clearly provides the necessary information; however, in those systems requiring subjects to respond only to the magnitude of the input signal, a compensatory display is indicated. (Author's abstract, in part)

686
Brown, Donald R.,
G. E. Briggs, and J. C. Naylor
THE RETENTION OF DISCRETE AND CONTINUOUS TASKS AS A FUNCTION OF INTERIM PRACTICE WITH MODIFIED TASK REQUIREMENTS.—Ohio State Univ. Lab. of Aviation Psychology, Columbus (Contract AF 33(616)-7269); issued by Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171003). Technical Documentary Report no. AMRL-TDR-63-35, May 1963. vi+18 p.

Laboratory research is reported on retention of continuous (tracking) and of discrete (procedural) tasks as a function of rehearsal conditions (simplified versus "operational" rehearsal tasks). All rehearsal conditions led to superior retention of the tracking task compared to a no-rehearsal condition, and certain of the procedural task scores indicated the same result. However, little evidence was found to indicate reliable differences among the several rehearsal conditions. It is concluded that sufficient original training will eliminate any potential differences among rehearsal conditions. (Authors' abstract)

687
Bush, R. D.,
F. H. Rohles, H. H. Reynolds, and F. G. Koestler
THE RELATIONSHIP BETWEEN SKIN TEMPERATURE AND PERFORMANCE IN THE JAVA MONKEY. —— Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6893, Task no. 689302). Technical Documentary Report no. ARL-TDR-62-21, Aug. 1962. vi+13 p.
Also published in: Jour. Applied Physiol., 18 (4): 752-755. July 1963.

Four male Java monkeys (Macaca iris), trained to perform a continuous avoidance task, were used in an exploratory study of diurnal skin temperature changes and their relationship to avoidance behavior. Significant diurnal skin temperature changes were detected, and a relationship with performance was shown to exist. While certainly not conclusive, these results suggest that further consideration should be given to work-rest cycles and concomitant body temperature changes. It is conceivable that optimal periods of performance can be derived from proper scheduling of critical work periods, which would circumvent decrements related to temperature changes. The results of this preliminary study should be considered in research where performance is measured over extended periods of time and, in particular, research in toxic hazards, psychopharmacology, monitoring tasks and tasks involved in prolonged space flight. (Authors' abstract and conclusions)

688
Chkhaidze, L. V.
[COORDINATION OF VOLUNTARY MOVEMENTS OF MAN IN THE CHANGED GRAVITATIONAL FIELD] Koordinatsiia proizvol'nykh dvizhenii cheloveka v izmenennom gravitatsionnom pole.— Problemy kosmicheskoi biologii (Moskva), 1: 438-450. 1962. In Russian, with English summary (p. 449-450).

Four test subjects exposed to an increased gravitational field (4 and 8 g) showed a marked change in voluntary movements: motor coordination was disturbed and the ability to discriminate the degree of muscular exertion was impaired. The extent of the disturbance is directly related to the state and training of the subject and the logarithm of gravity. After repeated exposures, motor coordination improves to practically normal values. It is concluded that exposure to increased gravitational forces could be used as a basis for the selection of cosmonauts.

689
Clark, R. E.,
and C. F. Flaherty
CONTRALATERAL EFFECTS OF THERMAL STIMULI ON MANUAL PERFORMANCE CAPABILITY.— Jour. Applied Physiol., 18 (4): 769-771. July 1963.

The performance capability of one hand was studied as a function of its surface temperature and that of the contralateral hand. Three findings were determined to be statistically reliable for the subject sample tested: (a) when the performing hand itself was cooled to a surface temperature of 40° F., performance decrements appeared which were independent of the temperature of the contralateral hand; (b) when the performing hand was kept warm, cooling of the nonperforming hand resulted in an average reduction of 33% in the time typically needed for the completion of the manual task; and (c) the surface temperature of a hand not exposed to the cold was found to fall an average of 2° F. below its normal level when the contralateral hand was cooled to surface temperatures of 55° F. or lower. (Authors' abstract)

690
Davis, R.
CHOICE REACTION TIMES AND THE THEORY OF INTERMITTENCY IN HUMAN PERFORMANCE. — Quart. Jour. Exper. Psychol. (Cambridge), 14 (3): 157-166. Aug. 1962.

One visual signal, drawn from two equi-probable alternatives, was followed at a variable interval by a similar signal, also drawn from two equi-probable alternatives. The relationship between reaction time to the second signal and the interval between signals was studied under two conditions: the subjects were instructed to regard the first signal as irrelevant or they were asked to report on the nature of the first signal after they had responded to the second. The interval between signals was one of the five values, 50, 100, 150, 200, or 250 milliseconds. In the regular interval situation the same interval was used over a block of 20 trials. In the random interval situation the values of the interval were randomly arranged. The results showed: (1) In the random interval situation there was a definite disturbing effect of the first signal on the reaction time to the second. (2) In the regular interval situation this disturbing effect was not evident. (3) Reporting on the nature of the first signal produced no consistent increase in reaction time to the second signal. Some implications of these results for the concept of the human operator as a channel of limited capacity are discussed. (Author's summary, modified)

691
Dureman, I.,
B. Jönsson, and B. Wilén
PROBABILITY DISCORDANCE AND CHOICE REACTION TIME. I. EFFECTS OF DISCORDANT PROBABILITY ON CHOICE REACTION TIME DURING PROLONGED TRAINING.—Scandinavian Jour. Psychol. (Stockholm), 4 (1): 33-36. 1963.

Successive development of disinhibitory action over long monotonous training periods was studied with choice reaction time stimuli possessing discordant properties related to their relative frequency and the direction of movement. The results indicate that stimuli with strong initial proactive interference on ensuing reaction to the critical probe-stimulus become, with prolonged training, the least interfering. (Authors' summary)

692
Fehrer, E.,
and D. Raab
REACTION TIME TO STIMULI MASKED BY METACONTRAST. —— Jour. Exper. Psychol., 63 (2): 143-147. Feb. 1962.

If a brief light flash is followed, after a suitable interval, by stimulation of adjacent retinal areas, its apparent brightness is reduced. This study was designed to determine whether metacontrast suppression of a light flash affects reaction time (RT) to the flash. Masking of a square target was achieved by subsequent flashing of two adjacent squares. Stimulus onset asynchronies were studied over a range from 0 to 75 msec. Phenomenal suppression of the first flash varied from none (0 asynchrony) to maximum (75 msec. asynchrony). With both foveal and peripheral vision, the results showed no effect of phenomenal brightness on RT. RT to the target, flashed alone, was never faster than RT to the target followed by masks. It was therefore the physical dimensions of the stimulus rather than its phenomenal characteristics that determined RT. (Authors' summary)

693
Fehrer, E.,
and I. Biederman
A COMPARISON OF REACTION TIME AND VERBAL REPORT IN THE DETECTION OF MASKED STIMULI. —— Jour. Exper. Psychol., 64 (2): 126-130. Aug. 1962.

The present study compares the accuracy of two measures, reaction time and verbal report, in the detection of an event subjected to retroactive masking. A 5-millisecond darkening of an otherwise steadily illuminated area was followed, after delays varying from 0 to 75 msec., by a 100-msec. illumination of two adjoining areas. At certain critical delays at which verbal detection of the test stimulus was little above chance accuracy, reaction time to the darkening of the test stimulus was not affected by the delayed presentation of the masking lights. Compared with verbal report, therefore, reaction time provided a far more accurate measure of the presence of the masked stimulus event. (Authors' summary)

694
Fitts, P. M.,
J. R. Peterson, and G. Wolpe
COGNITIVE ASPECTS OF INFORMATION PROCESSING. II. ADJUSTMENTS TO STIMULUS REDUNDANCY.—Jour. Exper. Psychol., 65 (5): 423-432. May 1963.

Three experiments are reported in which relative stimulus frequencies were varied in 9 choice tasks. The tasks involved naming numbers and pointing to lights. It was found that as redundancy increased, average reaction times to the frequent stimulus component decreased whereas reaction times to less frequent components increased, the differences being a linear function of redundancy. These effects were greater for the less compatible (vocal) task. Subjects used the frequent response more often and the infrequent response less often than appropriate in responding to redundant sequences. These results are in agreement with predictions from a stimulus sampling and sequential decision model in which it is assumed that reaction times and errors are a function of prior probabilities and the payoff matrix for correct and wrong, slow and fast responses, as well as a function of stimulus discriminability. (Authors' summary)

695
Fleishman, E. A.,
and J. F. Parker
FACTORS IN THE RETENTION AND RELEARNING OF PERCEPTUAL-MOTOR SKILL. —— Jour. Exper. Psychol., 64 (3): 215-226. Sept. 1962.

Two groups of subjects were trained extensively under different amounts of verbal guidance on a highly complex tracking task simulating the display characteristics and control requirements of an air-borne radar intercept mission. Within each group matched subgroups were retested after various no-practice intervals up to 24 months. Then additional retraining was given either massed or distributed over four days. Conclusions drawn from the final retesting were: (1) retention of proficiency on a complex, continuous control perceptual-motor skill was extremely high with rapid recovery of losses; (2) variations in retention interval from 1 to 14 months were unrelated to retention performance; (3) the level of proficiency achieved during initial learning was the most important factor in retention; (4) the type of initial training was unrelated to retention performance when the proficiency level after original learning was held constant; and (5) retraining under distributed practice conditions was superior to massed practice, although in transfer to later performance the differences had disappeared.

696
Glucksberg, S.
ROTARY PURSUIT TRACKING WITH DIVIDED ATTENTION TO CUTANEOUS, VISUAL AND AUDITORY SIGNALS.—Jour. Eng. Psychol., 2 (3): 119-125. July 1963.

Three separate experiments were performed. In each, rotary pursuit tracking was performed concurrently with a distractive signal-detection task. As the distractive task, the first experiment employed simple detection; the second, disjunctive detection requiring a spatial discrimination; and the third, disjunctive detection requiring an intensity discrimination. Each signal-detection task was tested using visual, auditory, and cutaneous stimuli, respectively. In each experiment, tracking performance was impaired only when attention to distractive visual signals was required. All detection tasks were adequately performed concurrently with tracking. (Author's summary and conclusions)

697
Golbus, M.,
and M. Aderman
PERFORMANCE AND REMINISCENCE AS A FUNCTION OF TURNTABLE HEIGHT IN A ROTARY PURSUIT TASK.—Ergonomics (London), 6 (2): 199-203. April 1963.

Sixty subjects were randomly divided into three equal groups which were given trials on a pursuit rotor at heights of 6, 12, and 18 inches below the subject's clavicle, respectively. Each group was divided into two sub-groups, one of which had 12 consecutive trials, and the other 10 consecutive trials followed by a 10 minute break and then two more trials. Although the mean time on target decreased somewhat with the height of the rotor turntable, changes were not significant. The expected significant improvement in performance following a short rest period was obtained, but it did not differ significantly with turntable height. (Authors' abstract)

698
Greenspoon, J.,
and J. E. Anderson
EFFECTS OF STIMULUS SIMILARITY AND DELAY ON TRANSFER OF TRAINING.—Florida State Univ., Tallahassee (Contract AF 33(616)-6408); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7183, Task no. 718306). Technical Documentary Report no. AMRL-TDR-63-26, April 1963. iv+33 p.

The effects of stimulus similarity and delay on transfer to a visual-motor task were investigated. Subjects were trained on the same stimulus value and then retrained on the same or different stimulus values after varying intervals of time. The results indicated that both variables significantly affected the amount of positive transfer, although the results were not unequivocal. The greatest amount of transfer occurred on stimulus values that were closest to the stimulus value of original training. Moreover, the longer time intervals between original learning and test of transfer tended to produce the greater amount of transfer. The transfer effect tended to be short-lived in that subjects who had no prior experience with the task were performing as well as the subjects with prior experience after a relatively small number of trials. (Authors' abstract) (26 references)

699
Hammes, J. A.,
and S. L. Wiggins
PERCEPTUAL-MOTOR STEADINESS, MANIFEST ANXIETY, AND COLOR ILLUMINATION. —— Perceptual and Motor Skills, 14 (1): 59-61. Feb. 1962.

This study attempted to evaluate the inhibiting and facilitating effects of red and blue color illumination on a perceptual-motor task performed by subjects different in degrees of manifest anxiety as measured by the Heineman Forced-Choice Anxiety Scale. A "stasiometer" developed by J. S. Grey was used to measure perceptual-motor steadiness. The task involved passing a ring over copper tubing. Any contact between the ring and the tubing constituted an error. Results indicate that low-anxious individuals tend to be superior to high-anxious individuals, at a low level of statistical significance. Color illumination seems to have insignificant effect in the present study. Male subjects were superior in performance to female subjects, and the interaction among the variables of anxiety, color, and sex approached statistical significance. (Authors' summary, modified)

700
Hershenson, M.
REACTION TIME AS A MEASURE OF INTERSENSORY FACILITATION. —— Jour. Exper. Psychol., 63 (3): 289-293. March 1962.

An experiment is reported in which reaction times (RT) were measured to light and sound presented singly and in combination. The chief experimental variable was stimulus onset asynchrony. The results may be summarized as follows: (a) Intersensory facilitation was demonstrated in that, for certain asynchronies, RTs were faster to the combination than to either stimulus alone. (b) Maximum facilitation occurred at or just beyond the point at which the asynchrony was equal to the difference in RT to the single stimuli. (c) Varying the intensity of the stimuli differentially affected the magnitude of facilitation. Reducing the light intensity resulted in less facilitation whereas reducing the sound intensity had no effect. (Author's summary)

701
Hodgkins, J.
REACTION TIME AND SPEED OF MOVEMENT IN MALES AND FEMALES OF VARIOUS AGES.—Research Quart., 34 (3): 335-343. Oct. 1963

Nine hundred and thirty men, women, and children ranging in age from 6 to 84 were tested to determine the differences between males and females of various ages in their speed of reaction and movement and to ascertain whether or not a relationship exists between reaction time and movement time. Results indicated that (a) males are faster than females in both reaction and movement; (b) speed of both functions increases up to early adulthood and then decreases; (c) peak speed is maintained longer by males in movement and longer by females in reaction; and (d) in the majority of groups studied, no relationship exists between speed of reaction and speed of movement. (Author's abstract)

702
Ivanova, M. P.
[ON THE RELATION BETWEEN THE DURATION OF THE DEPRESSION OF BASIC CEREBRAL ELECTRICAL RHYTHMS AND THE LATENT PERIOD OF THE MOTOR REACTION] O sootnoshenii dlitel'nosti depressii osnovnykh elektricheskikh ritmov mozga i latentnogo perioda dvigatel'noi reaktsii.—Zhurnal vysshei nervnoi deiatel'nosti (Moskva), 12 (3): 437-442. May-June 1962. In Russian.

The latent period of the motor reaction and the duration of the α-rhythm depression were shorter in subjects exposed to a visual stimulus located near the center of the visual field, than to peripheral stimulation. During employment of inhibitory stimulation there was an increase in the latent period and the length of the depression phase, while during the process of complex spatial differentiation of two positive and one inhibitory stimuli there was a paradoxical change not only in the magnitude of the latent period but also in the length of the alpha depression.

703
Jackson, K. F.
IMPAIRMENT OF HUMAN PERFORMANCE IN CONTROL.—In: Space research and technology, p. 15-17. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

As it is desirable to give a spacecraft pilot as much controlling work as possible, more information is required about the amount of work that a pilot can do, and about the conditions which affect the quality of his work. Two experiments in this field are described; (1) impairment of performance during actual intensive flying, and (2) multiple tracking test. The main results of the first experiment were the deterioration of performance during a watch, the lack of performance improvement during a series of four flights, and a tendency for pilots to fly better in turbulence than in calm when rested at the beginning of flights, and to fly worse in turbulent conditions at the ends of flights when they were tired. From the second experiment, it was determined that over-all measures of performance may be misleading because, when things seem to be going badly, the pilot may be working at his best level of performance and, within limits, the pilot will tend to work harder the more tasks he is given to do provided there is enough time to deal with each task adequately.

704
Jalavisto, E.,
A. Forsen, C. Lindqvist, T. Makkonen, and M. Tallqvist
AGE AND THE SIMPLE REACTION TIME IN RESPONSE TO VISUAL, TACTILE AND PROPRIOCEPTIVE STIMULI.—Annales Academiae scientiarum fennicae (Helsinki), Series A, V (Medica), no. 96: 1-12. 1962. In English.

In a preliminary series simple reaction times to visual stimuli and to a falling object were determined in 82 subjects whose ages ranged from 20 to 83 years. The mean reaction time for all ages was 0.291 second to light stimuli and 0.239 second to a falling ruler. In the final series the "ruler" experiments were modified to include the falling of the ruler as (a) recognized by sight, (b) recognized by sight and touch, and (c) recognized by touch only. These experiments were performed on (1) 20 subjects, 20-23 years old; (2) 32 subjects, 52-86 years old; and (3) 5 old patients with senile dementia. In all groups of subjects the reaction time was definitely shorter for the experiments b and c. The lower limit of experiment c was the same in healthy old women with previous test experience and young subjects, 0.086 and 0.093 second, respectively. It was definitely higher in the senile patients (0.169 second).

705
Jensen, B. T.
EFFECTS OF COMMUNICATION RESTRICTION IN A SMALL MAN-MACHINE SYSTEM. —— Jour. Engineering Psychol., 1 (3): 134-140. July 1962.

In this study three-men crews performed a tracking task under conditions of restricted communication or in a free-communication situation. While the task required sequential processing of information at different positions it could be performed even though the members were isolated. In terms of achievement the two groups of crews did not differ. The free-communication crews utilized the possibilities of cooperation, but the members also interfered with each other so that beneficial effects of this interaction apparently were canceled out. (Author's summary and conclusions, modified)

706
Kamchatnov, V. P.
[STUDY OF HIGHER NERVOUS ACTIVITY IN MAN DURING WORK IN TOTAL DARKNESS AND IN LIGHT] Issledovanie vysshei nervnoi deiatel'nosti u liudei, rabotaiushchikh v absoliutnoi temnote i na svetu.—Zhurnal vysshei nervnoi deiatel'nosti (Moskva), 12 (2): 213-216. March-April 1963. In Russian, with English summary (p. 216).

Forty women performed a psychomotor task in total darkness while 29 control subjects engaged in identical work in light. In darkness there was an increase in the average latent periods of positive motor reactions and a predominance of cortical inhibition over excitation. In general the test group exhibited a gradual decrease in cortical tone, which became especially apparent just before the lunch break and at the end of the working day.

707
Karlin, L.,
and R. G. Mortimer
EFFECT OF VERBAL, VISUAL, AND AUDITORY AUGMENTING CUES ON LEARNING A COMPLEX MOTOR SKILL. —— Jour. Exper. Psychol., 65 (1): 75-79. Jan. 1963.

In comparing the effects of various additional cues on performance of a compensatory tracking task, a verbal cue group was significantly superior in final training and transfer trials to a control group. Both visual and auditory cues were superior to the control but individually none of these differences was significant. Comparison of these with earlier results suggested that augmenting cues were most effective in transfer when they functioned to reward desirable patterns of behavior and develop standards of performance rather than to guide immediate action. (Authors' summary)

708
Kinkade, R. G.
A DIFFERENTIAL INFLUENCE OF AUGMENTED FEEDBACK ON LEARNING AND ON PERFORMANCE. —Ohio State Univ., Columbus (Contract AF 33(616)-6964); issued by Behavioral Sciences Lab. and Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio. Report no. AMRL-TDR-63-12, Feb. 1963. iv+10 p.

The hypothesis that the training value of augmented feedback in a tracking situation will depend upon the discernibility of input and fundamental feedback signals was investigated. Subjects performed a one-dimensional compensatory tracking task using a knob for positional control over the cursor. For two of four groups of subjects the reference element was noisy, oscillating at random about a null position, while for the other two it was not. Augmented feedback, in the form of auditory clicks at the rate of 2 per second when on target, was given one of each pair of groups during training. On subsequent tests the performance of the group trained with augmented feedback and performing with the noisy display deteriorated to the level of its control group trained without feedback. But the performance of the group trained with augmented feedback and performing on the noise-free display continued unchanged and superior to that of its control group trained without feedback. The results are regarded as confirming the hypothesis and as helping to explain previous contradictory findings on the value of augmented feedback. (Author's abstract)

709
Kushner, E. N.
EFFECT OF MOTIVATING INSTRUCTIONS ON SIMPLE REACTION TIME.—Perceptual and Motor Skills, 17 (1): 321-322. Aug. 1963.

Twenty-four male patients with no history of cerebral damage or psychosis and 24 non-hospitalized male subjects received 65 simple reaction time (RT) trials under constant 6-second foreperiod conditions. No preparatory signal was used. Time between onset of a visual stimulus and its termination by subject's depression of a telegraph key was the RT. Initially, all subjects received 35 trials followed by either success, failure, or standard instructions. Thirty additional trials were given. RTs of the hospitalized subjects were longer than those of the non-hospitalized subjects, but differences fell short of statistical significance. Differences between instruction subgroups were not significant, suggesting that motivating instructions do not affect simple RT performances. (Author's summary)

710
Lavery, J. J.
RETENTION OF SIMPLE MOTOR SKILLS AS A FUNCTION OF TYPE OF KNOWLEDGE OF RESULTS.—Canad. Jour. Psychol., 16 (4): 300-311. Dec. 1962.

The effectiveness of the knowledge of results (KR) in the retention of simple motor skills is discussed. It is suggested that if KR is presented in such a way that it enhances the cues which accompany each response, retention is better. Two experiments on KR, with three simple motor skills, are reported which lend support to this proposition. (Author's summary)

711
Leont'ev, A. N.,
and E. P. Krinchik
[ON SOME FEATURES OF THE HUMAN INFORMATION PROCESSING] O nekotorykh osobennostiakh protsessa pererabotki informatsii chelovekom.—Voprosy psikhologii (Moskva), 8 (6): 14-25. Nov.-Dec. 1962. In Russian, with English summary (p. 25).

Two series of experiments were performed to study (a) the relationship between the reaction time and the quantity of individual information transmitted by a signal, and (b) the reaction time in relation to the importance of the signal information. The reaction time varies with the amount of individual information in conformity with the logarithmic law. There is a regular deviation from the line of regression, with higher values in the range of frequent signals and significantly lower values in the range of rare signals. It is concluded that the perception of individual information by the subject is based on grasping and registration of the probability structure of offered stimuli. This explains the optimum distribution of reaction time between rare and frequent signals.

713
MacCanon, D. M.,
D. D. Eitzman, and J. E. Abbott
EFFECT OF OXYGEN INHALATION ON MANUAL PERFORMANCE IN THE COLD. —— Jour. Applied Physiol., 17 (3): 441-443. May 1962.

The effect of oxygen inhalation on block-stringing performance of 12 subjects was studied at hand temperatures of 32.7° C. in a control room environment of 29° C. and after cooling the hands to 16.0° C. in a cold (5° C.) environment. A similar slight but significant improvement in manual performance accompanied oxygen inhalation under both conditions. This is interpreted as indicating the existence of suboptimal neural and/or muscular activity during air breathing in both situations. If hand cooling had affected the same neural and/or muscular elements as oxygen, lowering activity even further from the optimal level, this should have exaggerated the oxygen effect. In view of the absence of such a response, it would seem that hand cooling and oxygen influence different neural and/or muscular elements, and their effects on manual performance are not directly related. (Authors' abstract)

714
McCormack, P. D.,
F. R. S. Binding, and J. Chylinski
EFFECTS ON REACTION-TIME OF KNOWLEDGE OF RESULTS OF PERFORMANCE. —— Perceptual and Motor Skills, 14 (3): 367-372. June 1962.

The effects of knowledge of results on reaction time were explored in two experiments. The subject pressed a switch in response to a visual signal. A red or green light after the response provided information whether the response was slower or faster than the previous one. These lights were not employed in one no-knowledge condition or presented simultaneously in the other no-knowledge condition. The second study employed a different sample of subjects and varied the time relationship of the experimental conditions. For both no-knowledge treatments, reaction time in the two experiments increased with time on task and decreased with length of the stimulus interval. Under the knowledge condition, however, performance remained invariant with respect to both task duration and interval length.

715
McCormack, P. D.,
F. R. S. Binding, and W. G. McElheran
EFFECTS ON REACTION TIME OF PARTIAL KNOWLEDGE OF RESULTS OF PERFORMANCE.—Perceptual and Motor Skills, 17 (1): 279-281. Aug. 1963.

Five groups of male subjects participated in a reaction time experiment under 0, 30, 50, 70, and 100% knowledge of results conditions. The only dependable change in reaction time with time on task was observed for the no knowledge group where reaction times became longer with increased task duration. (Authors' summary)

716
Morway, D. A.,
R. G. Lathrop, R. M. Chambers, and L. Hitchock
THE EFFECTS OF PROLONGED WATER IMMERSION ON THE ABILITY OF HUMAN SUBJECTS TO MAKE POSITION AND FORCE ESTIMATIONS.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask MR005.13-0005.7, Report no. 5). Report no. NADC-MA-6115, July 24, 1963. iv+21 p.

Twelve subjects using underwater breathing apparatus were immersed in water for 18 hours. Each subject's responses to two general psychomotor tasks were measured before, during, and after water immersion: (1) the ability to reach and position the arm and hand accurately and (2) the ability to estimate a prelearned level of force. Analysis of variance performed upon the target aiming task showed no significant difference in the horizontal aiming component. However, a highly significant ($p < .01$) bias upwards was observed in the vertical aiming component. Comparisons between trial means using the Duncan q' test indicate that the bias upwards declined as a function of immersion time. An analysis of variance performed upon the force estimation data showed a significant interaction between trials within blocks and test conditions. Duncan's q' Test Ordered Means Comparison revealed no significant difference between the pre- and post-immersion force estimations. The mean estimation obtained during immersion was significantly different ($p < .01$) from the pre- and post-trials. The force data showed no tendency to adapt as a function of time immersed. (Authors' summary)

717
Nance, R. D.
COMMENT ON SUDDON'S "PACED AND SELF-PACING PERFORMANCE ON A SIMPLE MOTOR TASK".—Perceptual and Motor Skills, 16 (3): 672. June 1963.

An objection is raised to the interpretation of the findings reported by Suddon (1963) on the self-pacing, i.e., that the paced groups were superior during retention but not during training. In addition to other possible explanations the author suggests replication of the experiment to explore a sexual bias.

718
Nance, R. D.
FURTHER COMMENT ON SUDDON'S WORK WITH PACING.—Perceptual and Motor Skills, 16 (3): 830. June 1963.

The argument on the specific definition of "pacing" of performance is analyzed with respect to its interaction with the effect of the delay in knowledge of results on performance.

719
Naylor, J. C.,
G. E. Briggs, and W. G. Reed
THE EFFECTS OF TASK ORGANIZATION, TRAINING TIME, AND RETENTION INTERVAL ON THE RETENTION OF SKILL. — Ohio State Univ., Columbus (Contract AF 33(616)-7269); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171003). Technical Documentary Report no. AMRL-TDR-62-107, Sept. 1962. vi+20 p.

The study investigated three independent variables (amount of training, task organization, and length of the retention interval) and their effects upon the long-term retention of both a discrete and a procedural task. Two levels of each variable were studied: 2 and 3 weeks of training, high and low organization of the procedural task, and 1- and 4-week retention intervals. Sixteen subjects were assigned to each of the eight experimental groups, assignment to groups being based upon a matching criterion of tracking performance. Amount of skill loss was found to be a function of amount of original training and task organization (under conditions of 2 weeks of training only). Amount of absolute retention, however, was found to be a function of all three independent variables. General conclusions of the study were that (a) amount of training is an extremely important retention variable; (b) under lesser training conditions, task organization becomes important; (c) task organization as a variable is probably a special case of degree of learning; and (d) there is a need for more multivariate retention studies. (Authors' summary)

720
Naylor, J. C.,
G. E. Briggs, D. R. Brown, and W. G. Reed
THE EFFECT OF REHEARSAL ON THE RETENTION OF A TIME-SHAPED TASK.—Ohio State Univ. Lab. of Aviation Psychology, Columbus (Contract AF 33(616)-7269); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171003). Technical Documentary Report no. AMRL-TDR-63-33, April 1963. vi+21 p.

Two studies were performed to investigate the influence of various methods of task rehearsal upon the retention of a time-shared task. Experiment I examined retention as a function of four rehearsal conditions (part task, whole task, simplified task, and none). Subjects in each of the groups trained for 8 days, returned 6 days later for 2 days of rehearsal, and then returned again after 7 more days for a retention test. Experiment II examined retention both as a function of three rehearsal methods (whole, part, and none) and amount of training (5 or 10 days). Subjects returned for 2 days of rehearsal 10 days after completion of training and then returned for retest 9 days later. Tracking performance in both studies showed significant effects due to rehearsal methods. In Experiment I part rehersal was superior, while in Experiment II whole rehearsal was found to be best. (Authors' abstract)

721
Obermayer, R. W.,
W. F. Swartz, and F. A. Muckler
INTERACTION OF INFORMATION DISPLAYS WITH CONTROL SYSTEM DYNAMICS AND COURSE FREQUENCY IN CONTINUOUS TRACKING. — Perceptual and Motor Skills, 15 (1): 199-215. Aug. 1962.

Skilled subjects performed single-dimension tracking with all combinations of (1) following and compensatory modes of information display, (2) position, rate, and acceleration control system dynamics, and (3) three frequencies of a complex tracking course. The results are presented in terms of the following measures: average error, average absolute error, root mean square error, time on target, hits, control stick count, and average absolute control movement. The data show that a high degree of interdependency exists between the effects of the experimental parameters. Description of the interaction between the effects of display, dynamics, and courses is complicated as the results differ from measure to measure. Since the effects studied may very well be the composite effects of other closed-loop tracking factors, and since the literature suggests the existence of other interacting effects, one can only reluctantly suggest that future research strategies include the study of higher order interactions than in this study. (Authors' summary)

722
Ol'shannikova, A. E.
[MANIFESTATION OF THE LAW OF FORCE UNDER TYPICAL AND ATYPICAL CONDITIONS FOR THE OPERATOR'S WORK] Proiavlenie zakona sily v usloviiakh, sopostavimykh i nesopastavimykh s usloviiami raboty operatora. — Voprosy psikhologii (Moskva), 8 (5): 31-44. Sept.-Oct. 1962. In Russian, with English summary (p. 44).

The time intervals of the motor response to visual stimuli were measured. There was a direct influence of the intensity (brightness) of the stimuli on the response time as well as on the speed of choice in motor reactions. In the test of error-free performance, however, there was no effect of stimulus intensity on the motor reaction time.

723
Pathak, J. D.,
Y. B. Dixit, and M. S. Rao
NORMAL VISUAL REACTION TIME: EFFECT OF MISSING A MEAL ON IT. — Jour. Indian Med. Assoc. (Calcutta), 38 (10): 530-532. May 16, 1962.

Visual reaction times during various times of the day were studied in 50 normal persons between 18 and 35 years of age. The mean reaction times were almost the same at 9 A.M., 12 noon, 3 and 4:30 P.M., but slightly longer in the early morning. Missing a meal did not affect the visual reaction time.

724
Raab, D.,
and E. Fehrer
SUPPLEMENTARY REPORT: THE EFFECT OF STIMULUS DURATION AND LUMINANCE ON VISUAL REACTION TIME. — Jour. Exper. Psychol., 64 (3): 326-327. Sept. 1962.

A study was performed on the relationship between the critical stimulus duration (CD) and luminance in the mediation of reaction time (RT). The CD ranged from 0.5 to 20 milliseconds at five luminances ranging from 3000 to 0.3 foot-lamberts. The results for four subjects showed the CD for moderately intense stimuli (3000 and 300 ft.-L) to be less than 0.5 msec.; at 30 and 3 ft.-L the CD lies between 2 and 5 msec.; at the weakest intensity the CD lies between 10 and 25 msec. These findings confirm that the form of the relation between luminance and RT will depend on stimulus duration unless each stimulus duration is above the CD. Also the minimal latency of the overt response to a target flash is determined very shortly after stimulus onset. Increasing duration ceases to be effective far above CD, which is consistent with the findings that RT is independent of the growth of phenomenal brightness.

725
Rachman, S.
DISINHIBITION AND THE REMINISCENCE EFFECT IN A MOTOR LEARNING TASK. — Brit. Jour. Psychol. (London), 53 (2): 149-157. May 1962.

Two groups of subjects performed a motor learning task on the pursuit rotor. The experimental group was presented with a brief disinhibiting alien stimulus (buzzer noise) during their 5-min. practice period. The disinhibitory stimulus maintained the performance level and produced significantly smaller reminiscence scores for the experimental group. A second experiment explored the timing of the alien stimulus. Four groups of ten subjects each were given the same pursuit rotor task to complete. Group A acted as a control, group B was presented with an alien stimulus early in the 5-min. practice period, group C late in the practice period, and group D very late in the practice. In addition to clarifying some of the earlier results this experiment showed that the effect of an alien stimulus on performance is most marked when it is introduced late in the practice period. (Author's summary, modified)

726
Riauzov, IU. A.
[ON THE MOTOR COORDINATION OF THE UPPER EXTREMITIES] O koordinatsii dvizhenii verkhnikh konechnostei.—Teoriia i praktika fizicheskoi kul'tury (Moskva), 25 (5): 37-40. May 1962. In Russian.

Twenty-two subjects performed a series of prescribed exercises involving antagonistic muscle groups of the upper extremities. The following results were obtained: the rate of symmetrical motions is higher than that of nonsymmetrical ones; and the latter have a tendency to become symmetrical in the course of rapid exercise. During motion of only one extremity, inclusion in the exercise of the other one tends to give the motion curve a symmetrical appearance.

727
Ryan, E. D.
RETENTION OF STABILOMETER AND PURSUIT ROTOR SKILLS.—Research Quarterly, 33 (4): 593-598. Dec. 1962.

The pattern of retention for two motor skills was studied in 80 college men. Subjects were given an initial learning trial for both tasks, then retested after 3, 5, 7, or 21 days of rest. Both skills exhibited little loss, although the pattern was not the same for both skills. On the pursuit rotor all four groups showed significant reminiscence, while on the stabilometer the trend was for performance to be impaired, although only the change for the 7-day group was significant. There was little relationship between ability to perform on the two tasks (r = .22). (Author's abstract)

728
Seibel, R.
DISCRIMINATION REACTION TIME FOR A 1,023-ALTERNATIVE TASK.—Jour. Exper. Psychol., 66 (3): 215-226. Sept. 1963.

Stimuli were all possible patterns of 10 lights. Responses were corresponding patterns of simultaneous key depressions in a 10-key keyboard (1 key for each finger). After more than 75,000 discrimination reaction times (DRTs) for each of 3 subjects, average DRT under the 1023-alternative condition exceeds that under a 31-alternative condition by less than 25 msec. DRT does not increase linearly with information transmitted. Learning curves for the 1023-alternative task are described. Idiosyncratic and relatively long-term performance shifts limit the precision of fit. (Author's summary, modified)

729
Shephard, A. H.,
D. S. Abbey, and M. Humphries
AGE AND SEX IN RELATION TO PERCEPTUAL-MOTOR PERFORMANCE ON SEVERAL CONTROL-DISPLAY RELATIONS ON THE TCC. — Perceptual and Motor Skills, 14 (1): 103-118. Feb. 1962.

Males and females at seven age levels from 5 to 70 years practiced continuously for 7 minutes on three control-display relations on the Toronto Complex Coordinator. Measures were taken of nine different aspects of performance, number of matches, number of vertical and horizontal initial movement errors, number of vertical and horizontal total errors, vertical and horizontal latencies, and vertical and horizontal persistence of errors. The results generally indicate that age, sex, and task together determine level of performance for each measure. Level of performance for the three tasks generally was ordered Standard, Reverse, and Out-of-Phase, with the Standard Task showing the largest number of matches, smallest number of errors, etc. Male performance was generally superior to female. Most of the curves for performance as a function of age were U- or inverted U-shaped with superior levels of performance in the middle age ranges. Results are examined in terms of a prior learning of directional relations hypothesis. Other hypotheses are suggested to account for the data, particularly in relation to changes in level of performance with changes in age at the upper range. (Authors' summary)

730
Siegel, J.,
and D. N. Robinson
PREDICTION OF VISUAL TRACKING PROFICIENCY ON AN A-SCOPE PRESENTATION.— Perceptual and Motor Skills, 16 (2): 357-360. April 1963.

Visual noise and temporal requirements of a compensatory tracking task were varied in order to determine time-on-target proficiency. Nine subjects were each given 32 trials in counterbalanced order, with problems varying as to visual noise and target acceleration. The display consisted of an A-scope with the subjects' task being to maintain a triangular pulse in the center of a stationary notch by manipulating a velocity controlled handwheel. The results show that the probability of success becomes greater as the time requirements become less severe. When the time requirements become more severe, the probability of success diminishes and the differential effects of noise become more pronounced. (Authors' summary, modified)

731
Siegel, J.,
and D. N. Robinson
EFFECTS OF SIGNAL-TO-NOISE RATIO AND TARGET ACCELERATION UPON THREE MEASURES OF RANGE TRACKING PERFORMANCE.— Perceptual and Motor Skills, 17 (1): 151-156. Aug. 1963.

Eight visual signal-to-noise ratios and four target accelerations were systematically varied in an attempt to determine functional relationships between these parameters and measures of time-on-target, frequency of target loss and the average duration of each loss on an A-scope compensatory tracking task. Nine subjects were required to maintain a triangular pulse in the center of a stationary notch by manipulating a velocity controlled handwheel. The results indicated that visual noise had a pronounced effect upon time-on-target, but the effects of target acceleration were negligible. However, target acceleration had a pronounced effect upon frequency of losing target track and both parameters affected average duration of a loss. The results are discussed in terms of analyzing system performance. (Authors' summary)

732
Suddon, F. H.,
and J. J. Lavery
THE EFFECT OF AMOUNT OF TRAINING ON RETENTION OF A SIMPLE MOTOR SKILL WITH 0- AND 5-TRIAL DELAYS OF KNOWLEDGE OF RESULTS.—Canad. Jour. Psychol., 16 (4): 312-317. Dec. 1962.

The effect of the amount of training with 0-trial delay and 5-trial delay of the knowledge of results (KR) on the level of retention is investigated. The results indicate that with both methods the amount retained is a function of the amount of training. However, it would seem that the interjection of retention trials into the training program actually modifies subsequent training under 0-trial delay, since subjects trained in this manner eventually retain the skill better than either those receiving more trials with KR over the same period of time or those receiving the same amount of trials with KR over a shorter period of time. (Authors' summary)

733
Surwillo, W. W.
THE RELATION OF SIMPLE RESPONSE TIME TO BRAIN-WAVE FREQUENCY AND THE EFFECTS OF AGE.—Electroencephalography and Clinical Neurophysiol. (Amsterdam), 15 (1): 105-114. Feb. 1963.

An experiment was performed to verify a previous finding of a positive correlation (0.81) between response time and period of the EEG. Details of this relationship, with reference to age and to a hypothesis concerning the function of the brain-wave cycle in simple behavior, were investigated. Reaction times and average period of the EEG, recorded in the interval of time between stimulus and response, were determined for 100 subjects ranging in age from 28-99 years. The major results were: (1) The previous finding was confirmed. In the present study a correlation coefficient of 0.72 was obtained between average reaction time and the average period of the EEG. (2) Excluding age from this relationship through the use of partial correlation scarcely altered this coefficient. Age as a factor in the observed correlation was therefore ruled out. (3) A highly significant positive correlation was obtained between the age of the subjects and the average period of their brain waves. (4) A low but statistically significant positive correlation was found relating average reaction time and age. This positive coefficient vanished and became negative when brain-wave period was "partialled out". It was inferred, therefore, that EEG frequency is the central nervous system factor behind age-associated slowing in response time. Evidence derived from data of each subject taken singly showed the presence of a positive correlation between brain-wave period and reaction time in individual subjects. Taken as a whole, the data support the hypothesis that the brain-wave cycle is the basic unit of time in terms of which a response is programmed by the central nervous system. (Author's summary) (25 references)

734
Taylor, M. M.
TRACKING THE NEUTRALIZATION OF SEEN ROTARY MOVEMENT.—Perceptual and Motor Skills, 16 (2): 513-519. April 1963.

Subjects controlled a rotating disc for 10 minutes, with instructions to keep the speed of the disc constant. Subjects actually increased the physical speed of the disc as the trial continued. The logarithmic increase in speed was proportional to the square root of the inspection time and was less for high initial speeds than for low. It was proportional to the Weber ratio. Most subjects showed less neutralization on the later trials. (Author's summary)

735
Warrick, M. J.,
and L. Turner
SIMULTANEOUS ACTIVATION OF BIMANUAL CONTROLS.—Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718404). Technical Documentary Report no. AMRL-TDR-63-6, Jan. 1963. 11 p.

The time interval between the release of a right-hand key and a left-hand key, when subjects were attempting to release them simultaneously, was measured to 0.1 millisecond. The mean interval of 20 subjects, 60 trials per subject without knowledge of results, was very close to zero (simultaneous). Approximately 94 per cent of the intervals were within ±20 milliseconds of zero. The implications of the findings to the control of a personal space-propulsion unit are discussed. (Authors'abstract)

736
Wiggins, S. L.,
J. R. Brokaw, R. V. Heckel, and H. C. Salzberg
MANIFEST ANXIETY AND PERCEPTUAL-MOTOR STEADINESS. — Perceptual and Motor Skills, 15 (3): 759-762. Dec. 1962.

The effectiveness of measured anxiety (Heineman Forced Choice Anxiety Scale) and judged anxiety (clinical evaluation) as predictors of performance on a perceptual-motor task was investigated in a group of 20 neuropsychiatric patients and in a control group of 10 college students. The perceptual-motor steadiness task consisted of timed passing of a ring over a piece of copper tubing. Touching the tubing was counted as an error. The results indicate that clinical evaluation of manifest anxiety was a better predictor of perceptual-motor performance than the scale. The stasiometer may be a useful indicator of performance in occupations where the anxiety factor has to be considered.

737
Wilkinson, R. T.
INTERACTION OF NOISE WITH KNOWLEDGE OF RESULTS AND SLEEP DEPRIVATION.—Jour. Exper. Psychol., 66 (4): 332-337. Oct. 1963.

100 db. "white" noise impairs performance of 30-min. choice serial reaction; does this effect vary under (Experiment I) 32-hr. sleep deprivation (SD) and (Experiment II) increased knowledge of results (KR)? Twelve enlisted men in each experiment carried out the 4 condition combinations in balanced order of presentation. The effect of noise was increased by KR, reduced by SD, and greater among subjects with previous practice on the test. Conclusions are: (a) noise impairs performance as incentive is high and as the task loses novelty through practice; (b) noise and SD produce different types of "fatigue" which may oppose each other's action; with SD arousal may be too low (especially with no KR); with noise it may be too high (especially with KR). (Author's summary)

738
Williams, A. C.,
and G. E. Briggs
ON-TARGET VERSUS OFF-TARGET INFORMATION AND THE ACQUISITION OF TRACKING SKILL. — Jour. Exper. Psychol., 64 (5): 519-525. Nov. 1962.

During training three experimental groups received augmented feedback (auditory clicks at the rate of two per second) when tracking accuracy was within (on-target criterion) or outside (off-target criterion) fixed tolerance limits. During transfer, no augmented feedback was provided. All three experimental groups were superior in tracking accuracy during training to a control group which did not receive augmented feedback. It followed that augmented feedback based on a simple off-target criterion was the most effective training condition. An analysis of the data suggested that this superiority was a result of the emphasis an off-target criterion places on occasional large tracking errors. The group trained on this condition apparently learned to reduce such errors more quickly and efficiently than did the on-target criterion group. (From the author's summary)

739
Williams, H. L.,
A. M. Granda, Richard C. Jones, A. Lubin, and J. C. Armstrong
EEG FREQUENCY AND FINGER PULSE VOLUME AS PREDICTORS OF REACTION TIME DURING SLEEP LOSS. — Electroencephalography and Clinical Neurophysiol. (Amsterdam), 14 (1): 64-70. Feb. 1962.

The validity of EEG frequency and finger pulse volume for predicting reaction time increased as sleep loss increased. In general, the EEG showed the highest correlation with reaction time, especially in the 1-second interval just before and just after the signal. As sleep loss increased, the "lead time" for the EEG increased so that by 50 hours of sleep loss, valid predictions of reaction time could be made at least 2-3 sec. before the signal. Five out of seven subjects showed a bimodal EEG frequency distribution during sleep loss. For these five subjects, perceptual-motor lapses occurred during periods in which the EEG frequency was in the theta rhythm (4-7 c./sec.) range. For two of the subjects whose modal EEG frequency slowed somewhat but did not have a secondary mode at 4-7 c./sec., neither the EEG nor finger pulse volume could be used to predict reaction time. Finger vasodilation was significantly related to long reaction times during sleep loss, but its contribution to the prediction of reaction time was small. (Authors' summary)

740
Zav'ialov, E. S.,
A. P. Kuz'minov, and V. I. Mankevich
[A DEVICE FOR RECORDING OF MOTOR AND SENSORY ACTS OF AN OPERATOR IN AUTOMATIC AND SEMIAUTOMATIC CONTROL SYSTEMS]
Ustanovka dlia registratsii dvigatel'nykh i sensornykh aktov operatora v avtomaticheskikh i poluavtomaticheskikh sistemakh upravleniia.—Voprosy psikhologii (Moskva), 9 (3): 130-133. May-June 1963. In Russian.

An automatic electronic device is described, which records various sensory and motor indices of an operator in the process of work.

g. Reflexes

741
Antal, J.
CONDITIONED REFLEX PREPARATION OF THE ORGANISM FOR MUSCULAR WORK.—Activitas nervosa superior (Praha), 4 (3/4): 284-293. 1962. In English.

Conditioned and unconditioned changes in respiration, thermoregulation, blood composition, and circulation during locomotor movements on a treadmill were studied experimentally with 60 dogs and 54 human subjects. The unconditioned changes were as follows: At the beginning of locomotion an increase in cardiorespiratory dynamics is observed. The respiration deepens and acceleration of heart rate sets in immediately, probably due to the intervention of conditioned and proprioceptive-visceral reflexes. In the first 10-12 seconds of locomotion the arterial pressure shows an initial drop as a result of vasodilation, and a subsequent rise above the resting levels. The magnitude of these changes is approximately proportional to the degree of muscular strain. Body temperature during normal running is raised by 1° C. Polypnea sets in immediately. Changes in blood composition are characterized by a rise in lactic acid concentration, specific gravity, packed cell volume, and red and white cell counts. The changes observed in dogs during sham running mediated through conditioned reflexes are qualitatively the same as the unconditioned changes but with the values 50-75% lower than those of the unconditioned changes. In human subjects conditioned reflex changes in respiratory dynamics are quickly elaborated to signals of muscular work. In contrast to dogs, conditioned response reflexes in human subjects are rapidly extinguished when unreinforced stimuli (signifying work) are repeatedly applied, and a drop in respiratory dynamics quickly replaces the rise.

742
Downes, H.
HYPERVENTILATION AND ABDOMINAL REFLEX INHIBITION IN THE RAT.—Anesthesiology, 24 (5): 615-619. Sept.-Oct. 1963.

The excitability of abdominal reflexes in the rat was investigated during varying degrees of passive pulmonary inflation with 100% O_2 or with low concentrations of CO_2 in oxygen. Hyperventilation was found to produce inhibition of abdominal muscle reflexes not referable to hypocapnia or hypotension. Possible mechanisms involved in the inhibition of abdominal reflexes during hyperventilation are discussed. (Author's summary)

743
Fernández, C.,
and R. S. Schmidt
STUDIES ON HABITUATION OF VESTIBULAR REFLEXES: EFFECT OF CALORIC STIMULATION IN DECORTICATED CATS.—Univ. of Chicago, Ill. (Contract AF 41(609)-1479); issued by School of Aerospace Medicine. Aerospace Medical Division, Brooks Air Force Base, Tex. (Task no. 775203). Technical Documentary Report no. SAM-TDR-63-61, Sept. 1963. iii+19 p.

Habituation of nystagmus elicited by repetitive caloric stimulation was studied in seven decorticated cats. The histopathologic studies revealed total ablation of neocortex, excepting small remnants in two cases, and extensive damage to basal ganglia and diencephalon. All animals exhibited response decline of nystagmus, demonstrating that neocortex and probably basal ganglia and diencephalon are not essential for inducing habituation. There were no conclusive data regarding transfer and long-lasting retention of the response decline. The locus and neurophysiologic basis of the phenomenon are discussed. (Authors' abstract) (45 references)

744
Herrick, R. M.
THE SUCCESSIVE DIFFERENTIATION OF A LEVER DISPLACEMENT RESPONSE.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask MR005.13-0002.16, Report no. 11). Report no. NADC-MA-6307, July 24, 1963. iv+29 p.

Maximum displacements of lever presses by rats were recorded under 8 successively-smaller "reinforcement zones" (RZ). The largest RZ included displacements from 3.29° to 44.01°; the smallest, from 23.65° to 28.74°. Work expended was linearly proportional to displacement. As the RZ decreased, displacement distributions reflected a "least effort" tendency: distributions peaked at the lower limit of RZ and most nonreinforced presses fell just below the lower limit. Successive distributions (a) differed significantly, (b) showed reduced variability, and (c) reinforcement. The effect on a given response class was less, relatively, when that class was eliminated from the RZ than it was when a higher response class was eliminated. A modified differentiation procedure is recommended. (Authors' summary)

745
Spinelli, N.,
P. Ceretelli, and G. Carrera
EFFECTS OF HYPOXIA AND FATIGUE ON CORTICAL REFLEXES.—Revue de médecine aéronautique (Paris), 1 (2): 141-145. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (1): 14-16. Jan. 1963.

The blinking reflex evoked by a flash of light was repeated every two to four seconds with the subject sitting in front of the flash at a distance of about six and one-half feet. The response of the orbicular muscle to a flash of light consisted of a group of action potentials beginning about 60-80 msec. after the stimulation. Induced hypoglycemia (insulin injection), hyperglycemia (glucose administration), hypocapnia (hyperventilation), hypercapnia (breathing 4.5% carbon dioxide in air), and hypoxia (breathing oxygen-deficient air) all produced increases of the total reflex time. Sleep deprivation of 36 hours had a similar effect.

746
Taylor, E. R.,
and R. F. Chandler
A SIMPLE REFLEX SENSOR: A DESCRIPTION AND TRIAL USE.—Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850, Task no. 785001). Technical Documentary Report no. ARL-TDR-62-23, Sept. 1962. v+13 p.

An instrumental technique of measuring the patellar reflex has been devised and is described. This technique requires a commercially available accelerometer, a 6-volt battery and a standard clinical electrocardiograph. Based upon preliminary trial with this device, the following conclusions are made: (1) The time interval from stimulus to maximum muscular response can be measured accurately and reproducibly. (2) The device is simple, sturdy and safe for use in subjects undergoing abrupt acceleration. (3) The unique capability of measuring the time interval to maximum muscular force has certain theoretical advantages over presently existing devices. Further evaluation is being made on normal and neuropathological subjects. (Authors' conclusions)

747
Taylor, E. R.,
and L. W. Rhein
THE NATURE OF REFLEX BRISKNESS.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850, Task no. 785001). Technical Documentary Report no. ARL-TDR-62-27, Dec. 1962. v+9 p.

An accelerometer sensor was used in the testing of patellar and other deep tendon reflexes. A qualitative difference was noted in the time-history and wave form produced by patients with the clinical picture of "increased briskness" due to well-demonstrated upper motor neuron pathology. The "brisk" reflex achieves maximum force in the same time as normal, but maintains this force at approximately the same level for .04 to .10 second; at this time damping occurs quickly. In contrast, normal subjects exhibit damping instantaneously after reaching peak acceleration. Thus, the phenomenon of briskness is a prolongation of peak acceleration, hence of peak force. (Authors' abstract)

h. Other Senses

748
Aftanas, M.,
and J. P. Zubek
EFFECTS OF PROLONGED ISOLATION OF THE SKIN ON CUTANEOUS SENSITIVITY.—Perceptual and Motor Skills, 16 (2): 565-571. April 1963.

Isolation of a circumscribed area of skin for a week by means of a perforated plastic cup affixed to the forearm resulted in an increase in tactual acuity. Application of constant pressure to the same area for a week was followed by decreased tactual acuity. These changes were still evident two days after the experiment. It is believed that central rather than peripheral factors are responsible for these changes. Temperature and pain sensitivity were not affected. (Authors' summary, modified)

749
Chatterjea, R. G.
TIME GAP IN THE ESTIMATION OF LONG DURATION.—Perceptual and Motor Skills, 17 (1): 143-149. Aug. 1963.

Using flash durations of 2, 4, 8, 16, and 32 seconds, reproduced estimates of duration as well as of the time gap between stimuli were obtained for 23 subjects under three experimental conditions (involving immediate and variously delayed time estimation). In general, all the durations were overestimated in all the three conditions. Included are representative figures and tables. (Author's abstract, modified)

750
Dawson, W. W.
ELEVATION OF THE THERMAL THRESHOLD BY EXPERIMENTALLY INDUCED LOCAL VASOCONSTRICTION.—Army Medical Research Lab., Fort Knox, Ky. (DA Project no. 3A012001B801). Report no. 577, June 10, 1963. ii+13 p.

Judgments of the onset of the subjective quality "warm" were made for areas of the forehead and forearm during stimulation by radiant energy in the 500-1500 $m\mu$ band. Forearm areas previously vasoconstricted by the iontophoresis of adrenalin chloride exhibited statistically higher thresholds to radiant warming than did normal control areas. Vibratory thresholds were unaffected by the vasoconstriction. Thermal thresholds were found to bear a positive correlation with the calculated reduction in superficial circulation produced by the iontophoresis. The results support the independence of the tactile and thermal transducing systems and suggest that the vascular structures play an important role in the sensation of superficial temperature change. (Author's abstract) (25 references)

751
Eijkman, E.,
and A. J. H. Vendrik
DETECTION THEORY APPLIED TO THE ABSOLUTE SENSITIVITY OF SENSORY SYSTEMS. — Biophys. Jour., 3 (1): 65-78. Jan. 1963.

The skin senses of touch and warmth were investigated. The decision model (statistical detection of a signal in presence of additive noise by adopting an adjustable decision level) describes the experimental data better than the threshold model. The experiments lead to the assumption that an internal noise exists, which is a neural activity being undistinguishable from the neural activity caused by small stimuli and which adds to the neural activity caused by the stimulus. The probability distribution of this internal noise can be considered to be Gaussian. The relation between stimulus and neural activity is alinear for the touch sense. The question of whether noise of a multiplicative nature must be assumed is discussed. (Authors' abstract, modified)

752
Farfel, V. S.
NON-GRAVITATIONAL POSTURAL AND MOTOR PROPRIOCEPTIVE REACTIONS IN MAN [Abstract]. —International Congress of Physiological Sciences, 22 (Leiden, 1962). Proceedings, vol. 2, no. 944. Amsterdam [1962?].

To study the proprioceptive reactions to the impact of tensile forces, gravitational effects have to be eliminated, providing conditions of physiological rest for the links of the body. The simplest and most available method of creating non-gravitational conditions is to study the movements of the links of the body, performed in a strictly horizontal plane. A series of devices (equitometers) has been constructed, which enables study of the non-gravitational interactions of antagonistic muscular groups. All this resulted in the detection of various manifestations of the elastic properties of the muscle to be extended, reflex reactions to tension, expressions of the contractile and plastic tone, cross-reciprocal relations in the movements of the extremities, cases of asymmetry of symmetrical-muscle tone of the body which assumes a scoliotic posture and a rhythmic motor reflex of the muscles of the trunk and of the lower and upper extremities. (Author's abstract)

753
Kamchatnov, V. P.
[ON THE CUTANEOUS SENSITIVITY IN MAN DURING WORK IN DARKNESS AND LIGHT] O kozhnoi chuvstvitel'nosti u rabotaiushchikh v temnote i na svetu.—Zhurnal vysshei nervnoi deiatel'nosti (Moskva), 12 (1): 37-39. Jan.-Feb. 1963. In Russian, with English summary (p. 39).

The cutaneous sensitivity was determined by means of a Weber esthesiometer in seven female laborers during a two-day period of work in total darkness, and in eight females during daylight work. The sensitivity of laborers exposed to total darkness was much lower than that of daylight workers.

754
Kenshalo, D. R.,
and J. P. Nafe
CUTANEOUS VASCULAR SYSTEM AS A MODEL TEMPERATURE RECEPTOR.—Perceptual and Motor Skills, 17 (1): 257-258. Aug. 1963. (NASA Research Grant NsG-148-61)

Simultaneous measurements were made of changes in the threshold for cool stimuli and of cutaneous vasodilatation as a function of the temperature to which the skin was adapted. The close correspondence of the changes in these two measures, which result from changes in skin temperature, suggests that the cutaneous vascular system may have value as a model for temperature receptors. (Authors' summary)

755
Kleber, R. J.,
W. T. Lhamon, and S. Goldstone
HYPERTHERMIA, HYPERTHYROIDISM, AND TIME JUDGMENT. — Jour. Compar. and Physiol. Psychol., 56 (2): 362-365. April 1963.

Subjects with hyperthyroidism and subjects with raised body temperature judged auditory inputs in relation to their concept of a clock second. Both organismic states resulted in an overestimation of the auditory durations, providing shorter inputs for temporal conceptual equivalence. The findings were predicted with reference to a model of the organism as an event-producing and counting clock, and the results conformed to previous work on time judgment and drugs and temperature. (Authors' summary)

756
Kurilova, L. M.
REFLEX CHANGES IN THE SENSITIVITY OF MAN TO TEMPERATURE.—Sechenov Physiol. Jour. USSR (Pergamon Press, New York), 47 (8): 1055-1062. Feb. 1962.

English translation of: Reflectornye izmeneniia temperaturnoi chuvstvitel'nosti cheloveka.—Fiziologicheskii zhurnal SSSR (Moskva), 47 (8): 965-970. Aug. 1961. In Russian.

Examination of the reflex effects of the central nervous system on the activity of thermoreceptors in the skin of man showed that the number of functional cold and hot receptor spots in the skin of the forearm could increase or decrease on heating and cooling of the trunk. Reflex changes in the number of functioning thermoreceptors in the skin were observed in relation to the action of photic stimulations on the eye. The view is advanced that the central nervous system directly influences the activity of skin thermoreceptors. (Author's conclusions)

757
Lhamon, W. T.,
R. Edelberg, and S. Goldstone
A COMPARISON OF TACTILE AND AUDITORY TIME JUDGMENT. — Perceptual and Motor Skills, 14 (3): 366. June 1962.

The mode of sensory input was found to be an important variable in forming temporal judgments. Intersensory comparison of temporal judgments has shown that visual inputs of longer duration than auditory inputs are estimated as equivalent to a clock second. In this experiment auditory Second Estimation Points (SEPs) were significantly longer than tactile SEPs.

758
Melzack, R.,
G. Rose, and D. McGinty
SKIN SENSITIVITY TO THERMAL STIMULI. — Exper. Neurol., 6 (4): 300-314. Oct. 1962.

Distribution patterns of cutaneous thermal sensitivity in human subjects were studied by mapping large areas of skin with stimulators the tip temperatures and diameters of which were controlled. The maps show that skin sensitivity to cold and warm stimuli is distributed in the form of large sensory fields rather than isolated "spots". These sensory fields have a variety of sizes and shapes. Generally, they consist of highly sensitive areas, ranging in size from 6 cm.^{2} to spot-like peaks, surrounded by larger, less sensitive regions. Moreover, there are persistent fluctuations of thermal sensitivity in successive maps of the same area of skin. Fluctuation usually took two forms: marked changes primarily at the boundaries of the sensory fields; and "fragmentation" and "coalescence" of the fields themselves. It was also observed that small, warm stimuli produce frequent reports of pricking, stinging sensations at temperatures that evoke pleasant warmth when applied normally to large areas of skin. This observation suggests that the spatial properties of warm stimuli play an important role in determining the quality of cutaneous experience. (Authors' abstract)

759
Stone, H.
INFLUENCE OF TEMPERATURE ON OLFACTORY SENSITIVITY.— Jour. Applied Physiol., 18 (4): 746-751. July 1963.

The olfactory response to acetic acid was studied at six experimental temperatures (12.5°, 15°, 20°, 25°, 30°, and 35° C.) for a trained panel of ten subjects. Determination of the 50% thresholds indicated no significant differences in olfactory sensitivity at the various environmental temperatures. Further analysis of the data indicated two significantly different groups of differing absolute sensitivity; however, no influence of temperature on olfactory sensitivity was noted. The 50% threshold for acetic acid was found to be 39.0 x 10^{-4} mg./liter air (0.65 x 10^{-7} moles/liter air) for the pooled data. Temperature recordings of inhaled and exhaled air in the nasal cavity suggested inspired air was rapidly equilibrated with body temperature by heat provided by the conchae. These data corroborate the conclusions of the sensory tests and explain the lack of change in odor threshold at different environmental temperatures. The inspired air stream is rapidly warmed to body temperature and any apparent changes in olfactory sensitivity would appear to be physical phenomena and not response to a true olfactory stimulus. (Author's abstract)

760
Tejmar, J.
AGE DIFFERENCES IN CYCLIC MOTOR REACTION. — Nature (London), 195 (4843): 813-814. Aug. 25, 1962.

The time judgment in man was investigated experimentally by observing motor reproduction (by tapping) of 5-second intervals for two minutes after one minute of training. Adults, both men and women, tended to underestimate the length of their motor reproduction, producing intervals longer than 5 seconds, as compared to children who tended to overestimate the duration of their tapping. The author suggests that a tendency to underestimation of the passage of time rises with age.

761
Verrillo, R. T.
INVESTIGATION OF SOME PARAMETERS OF THE CUTANEOUS THRESHOLD FOR VIBRATION. — Jour. Acoust. Soc. Amer., 34 (11): 1768-1773. Nov. 1962.

Sensitivity to vibration on the hand was determined as a function of frequency, contactor dimensions, contactor configuration, and distance of the contactor from a rigid support. It was found that each of these parameters affects the threshold in a different way. In the frequency range between 25 and 640 c.p.s., the absolute threshold as a function of frequency yields a U-shaped curve that reaches a maximum of sensitivity in the region of 250 c.p.s. The effect of the geometric parameters appears to be highly complex. (Author's summary)

762
Werboff, J.
TIME JUDGMENT AS A FUNCTION OF ELECTROENCEPHALOGRAPHIC ACTIVITY. — Exper. Neurol., 6 (2): 152-160. Aug. 1962.

Forty-eight male college students made time judgments of 2- and 8-sec. intervals under four experimental conditions with photic stimulation selected to alter frequency (wave-count) of EEG activity. The results indicate that subjects with more than 50% alpha in their eyes-closed resting EEG overestimated time in the eyes-open condition in contrast to those subjects with less than 50% alpha. Intermittent photic stimulation resulted in underestimation of the 8-sec. interval only. This was not due to changes induced in the EEG. Correlation of wave-count scores and time estimations showed the predicted inverse relation between increased relative frequency of the EEG and underestimation of temporal experience. An inherent mechanism of cerebral activity correlated with cerebral metabolism and control of temporal experience is suggested. (Author's summary, modified)

5. PSYCHOLOGY AND PSYCHIATRY

[Environmental Effects Under 6]

a. General

763
Beach, L. R.,
and R. W. Shoenberger
THE INFLUENCE OF EVENT SALIENCE ON RESPONSE FREQUENCY IN A TEN-ALTERNATIVE PROBABILITY LEARNING SITUATION.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. Mr005.13-5001, Subtask 12). Report no. 4, July 19, 1963. ii+8 p.

The influence of the salience of stimulus events on the relative frequency of response in a ten-alternative probability learning situation was investigated. Salience was defined as the difference in relative frequency of occurrence of an event and the relative frequencies of occurrence of the events surrounding it on an underlying physical or conceptual dimension. Four event-frequency distributions providing varying levels of event salience were used. An attempt was also made to examine spatial generalization effects of the salience of the high-frequency events to those which lie closest to them on the display. It was found that with increased salience of an event there was a corresponding increase in the degree to which subjects' relative frequency of response "overshot" its relative frequency of occurrence. The data suggest that generalization effects exist, but that the relationships are more complex than hypothesized and merit further study. (Authors' abstract)

764
Buschke, H.
AUDITORY AND VISUAL INTERACTION IN IMMEDIATE MEMORY.—Jour. Psychiat. Research (Oxford), 1 (3): 229-237. Dec. 1962.

Simultaneous auditory and visual displays of different numbers were presented serially to 36 normal human subjects who were instructed to indicate their recognition of any repetitions in each series so that homo-modal and hetero-modal retrieval from immediate memory storage might be compared. Auditory input was retained best, repetitions in either modality were equally effective in retrieval, and retrieval of both modalities of input was proportional to their contribution to total retained input. (Author's summary)

765
Cardozo, B. L.,
and F. F. Leopold
HUMAN CODE TRANSMISSION: LETTERS AND DIGITS COMPARED ON THE BASIS OF IMMEDIATE MEMORY ERROR RATES.—Ergonomics (London), 6 (2): 133-141. April 1963.

Experiments are described which were set up to study in information-theory terms some aspects of so-called "immediate memory" in the retention of codes consisting of letters and digits. The results show that errors began to occur when the codes presented more than about 20 bits. This result held for both letters and digits, so that single presentations of four letters or five digits were almost always reproduced without error. Differences in performance among subjects were not characterized by a shifting of the point at which errors began to occur but rather by the percentage of information above 20 bits that could be transmitted. (Authors' abstract)

766
Chambers, R. M.
PROBLEMS AND RESEARCH IN SPACE PSYCHOLOGY. — Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Task no. MR005.13-1004.1, Report no. 6). Report no. NADC-MA-6145, April 24, 1962. v+90 p.

The scientific literature is systematically reviewed for the following problem areas of the psychological aspects of space flight: (1) psychological requirements for man in space, (2) sensing and perceiving, (3) perceptual and motor skill performance, (4) cognitive processes and other higher mental abilities, (5) personality and emotional behavior, (6) psychological aspects of astronaut selection, and (7) psychological conditioning and training. The first five of these are basic research areas involving the abilities and capabilities of man in space environments. The last two areas are more concerned with the application of psychological principles to improve the reliability of man for serving as a functional component within manned space systems. A bibliography consisting of 208 references is included.

767
Craddick, R. A.,
and M. R. Stern
EFFECT OF PRE- AND POST-STRESS UPON HEIGHT OF DRAWINGS IN A PERCEPTUAL-MOTOR TASK.—Perceptual and Motor Skill, 17 (1): 283-285. Aug. 1963.

Forty male volunteers were randomly assigned to one of four experimental groups which received 10, 15, or 25 g, under abrupt deceleration conditions at the end of a 120-ft. sled run. A battery of tests, including the Graham-Kendall Memory-for-Designs (MFD) test was administered to each subject during an initial testing period under normal test conditions. About one month later, each subject was given a three-test battery, including the MFD, prior to the sled run (pre-stress period) and about 25 minutes after experiencing impact (post-stress period). The mean height of the 15 MFD drawings was analyzed for each subject for each group at the three periods. This analysis supports the hypothesis that, although the control group showed essentially no change in height of drawings over the three trials, the experimental groups exhibited a significant decrease ($p < 0.01$) in height of drawings during the pre-stress period. The decrease in drawing size was not a function of the number of g experienced but seemed to be a result of the anticipated stress. (From authors' summary)

768
Cratty, B. J.,
and A. E. Densmore
ACTIVITY DURING REST AND LEARNING A GROSS MOVEMENT TASK.—Perceptual and Motor Skills, 17 (1): 250. Aug. 1963.

Thirty females were randomly assigned to three groups of 10 and required to traverse a maze blindfolded as quickly as possible. During the rest periods between trials, Group 1 engaged in knot tying, Group 2 in symbol cancellation, and Group 3 engaged in no overt activity. The interpolated activities were selected as representing a motor task and mental task, respectively. Variance analyses at trials 1, 6, and 10 revealed no significant differences in the mean traversal speed among the groups.

769
Grether, W. F.
PSYCHOLOGY AND THE SPACE FRONTIER. — Amer. Psychologist, 17 (2): 92-101. Feb. 1962.

The contribution of psychologists to space flight work is summarized according to its historical progression with emphasis on engineering psychology. The work of a few outstanding psychologists in the Project Mercury is cited, e.g., in astronaut selection, training, and performance data. Others contributed analysis of work load during Mercury flights, development of a new type of attitude indicator, analysis of equipment failure, simulator design, and research on the effects of weightlessness. Future areas for research deal with overcoming effects of prolonged confinement to a small space vehicle, human performance in zero-g conditions, perceptual problems in space, and diurnal cycle adjustment.

770
Hoffman, H. S.,
and M. Fleshler
STARTLE REACTION: MODIFICATION BY BACKGROUND ACOUSTIC STIMULATION.—Science. (Washington), 141 (3584): 928-930. Sept. 6, 1963.

Six rats were exposed to a sequence of gunshot-like acoustic bursts during silence or during steady noise. Assessment of their startle reactions to the bursts revealed that a background of steady noise enhanced the response, whereas a background of pulsed noise produced suppression of response. It is hypothesized that pulsed noise causes a relative refractory state in the mechanisms responsible for startle and that steady noise may enhance startle by masking uncontrolled punctiform acoustic stimuli. (Authors' abstract)

771
Howell, W. C.,
F. Weizmann, and L. P. Schrenk
AN EVALUATION OF TWO VARIABLES CONTRIBUTING TO THE DIFFICULTY OF A SEQUENTIAL DECISION TASK.—Ohio State Univ. Lab. of Aviation Psychology, Columbus (Contract AF 33(616)-7122); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718403). Technical Documentary Report no. AMRL-TDR-63-58, June 1963. vi+16 p.

Subjects responded to four number sequences increased linearly, but at different rates, with each increasing sequence obscured by random variations. Both the rate of increase and the variability of the sequences were experimentally controlled. The subjects' task was to predict, as early in the sequence as possible, which one of the four sequences would attain the largest value at the end of 100 presentations. The subjects' performance was best when the difference between the rates of increase of the four number series was large and when the variability was small; however, increasing the difference between the rates of increase of the four sequences improved performance more than did reducing the variability. It is suggested that the ratio of variability to difference-in-rates-of-increase may be a useful index of task difficulty. Using this index, it appeared that subjects accepted a greater risk of error on difficult than on easy decisions. (From the authors' abstract)

772
King, H. E.
THE RETENTION OF SENSORY EXPERIENCE. I. INTENSITY.—Jour. Psychol., 56 (2): 283-290. Oct. 1963.

The accuracy of human subjects in retaining an experience of sensory intensity over long delay intervals was observed. Standard stimuli, presented briefly in the visual and auditory modalities, were matched by a manual adjustment of intensity controls following a delay of minutes, days, or weeks. The approximations made to "traces" of the intensity dimension of selected stimuli demonstrated a remarkable stability over long delay periods, evanescing only slowly, or not at all, over a one-month period of observation. Greater changes were observed for matches made to auditory than to visual stimuli; matches for both senses showed the largest shifts in judged intensity equivalence after the shortest delay. (Author's summary)

773
King, H. E.
THE RETENTION OF SENSORY EXPERIENCE. II. FREQUENCY.—Jour. Psychol., 56 (2): 291-298. Oct. 1963.

The accuracy with which naive human observers were able to reproduce an experience of sensory frequency after short and long intervals of delay was determined. Standard visual and auditory stimuli were presented at known frequency rates for a five-second period, then matched by a manual adjustment of a variable frequency control following delays of minutes, days, and weeks. The approximations made to "memory" of the frequency characteristic of the sample stimuli demonstrated remarkable stability, for both senses, over all delay periods. A constant error in the direction of raised frequency was noted in both modalities that appeared to be much the same after all intervals of delay. Judged equivalence of frequency in both modalities showed the greatest shift after the shortest delay interval. (Author's summary)

774
King, H. E.
THE RETENTION OF SENSORY EXPERIENCE. III. DURATION.—Jour. Psychol., 56 (2): 299-306. Oct. 1963.

The accuracy of human subjects in reproducing an experience of sensory duration following short and long delay periods was observed. Standard intervals presented via visual and auditory modalities were matched by a nonverbal reproduction after delays of minutes, days, and weeks. The approximations made to a "trace" of stimulus duration showed remarkable stability, in both modalities, over all periods of delay, indicating little or no evanescence over the one-month period of study. A consistent underestimation was noted among interval reproductions of both visual and auditory stimuli. The greatest error in judged temporal equivalence was observed after the shortest delay. (Author's summary)

775
Mackworth, J. F.
PRESENTATION RATE AND IMMEDIATE MEMORY. — Canad. Jour. Psychol. (Toronto), 16 (1): 42-47. March 1962.

Eight- and nine-digit messages at rates of 0.25 to 2.0 seconds/digit were presented on films to Royal Canadian Air Force cadets and to 20 women. Increasing the speed of presentation greatly reduced the amount that could be immediately recalled in correct order, but women fared less well in recalling the nine-digit messages. Reducing the speed of presentation improved the scores. No evidence was found to validate the decay theory.

776
Mackworth, J. F.
THE EFFECT OF DISPLAY TIME UPON THE RECALL OF DIGITS. — Canad. Jour. Psychol. (Toronto), 16 (1): 48-54. March 1962.

Subjects were required to recall sets of digits immediately after visual presentation, under varying conditions of message duration and number of digits displayed simultaneously. It was found that when the display variable was constant the amount recalled was proportional to the logarithm of the mean time per digit; when the mean time per digit was kept constant the amount recalled was proportional to the logarithm of the number of digits displayed simultaneously. However, the two variables were not interchangeable in their effect on the recall score. No evidence was found to support the decay theory when the display was kept constant, but a cross-comparison between different times and displays could be interpreted in support of this theory. (Author's summary)

777
Mackworth, J. F.
THE RELATION BETWEEN THE VISUAL IMAGE AND POST-PERCEPTUAL IMMEDIATE MEMORY.—Jour. Verbal Learning and Verbal Behavior, 2 (1): 75-85. July 1963.

These experiments investigated the relation between immediate recall of visually presented digits, letters, colors, and shapes and various methods of presentation, in order to illustrate the use of a simple equation which give a quantitative analysis of the factors involved. This analysis was based on the assumption that the whole of the recall task involved a constant amount of a quantity called the A-factor. Experiment I compared single and block presentation of three speeds (0.25 to 1 sec./item); Experiment II studied single presentation at exposures from 1 to 2 sec.; Experiment III studied block presentation at exposures from 0.1 to 6 sec.; and Experiment IV examined the effect of message length upon the recall of the four materials. The results lead to the conclusion that report from the 0.1 sec. exposure was made from a rapidly decaying preperceptual visual image, and was limited by the speed of recognition, which itself was limited by the same difficulties that affect the postperceptual immediate recall. (From the author's summary)

778
Pawlik, K.
[PSYCHOLOGICAL MEASURES OF ACTIVATION] Psychologische Masse der Aktivierung.—Zeitschrift für experimentelle und angewandte Psychologie (Göttingen), 10 (1): 19-34. 1963. In German, with English summary (p. 32).

Sixty-three subjects were tested in 24 hypothetical behavioral measures of the habitual activation level. In addition, each subject took a standard electroencephalographic examination. As to the latter, scoring was confined to characteristics of the alpha frequency range. For each of three selected recording channels correlations of the behavioral variables were computed with (a) per-cent time alpha, alpha frequency, and alpha amplitude, and (b) a derived EEG activation factor. A theoretical interpretation of the findings is briefly indicated. (Author's summary) (32 references)

779
Platonov, K. K.
[THE TASKS AND STATUS OF AVIATION PSYCHOLOGY IN USSR] O úloze a stavu letecké psychologie v SSSR.—Československá psychologie (Praha), 6 (4): 347-358. 1962. In Czech, with English summary (p. 358).

Aviation creates a series of problems dealt with by specialized branches of various fields of science, including aviation psychology. Its task is to investigate psychological data in a specific aviation activity and to apply them as regards pilots' activities. The chief tasks of aviation psychology are psychological problems of aviation activity, of pilot training, or organization of flights, of arrangement of working conditions (aviation engineering psychology) and "professiograms" of aviation activity, apart from the problems of research methods and history of aviation psychology. In the USSR aviation psychology is a well founded discipline, both in theory and practice. The research tasks are unified and tested directly in practice. With the development of aviation technique, aviation psychology is becoming still more important and at the present time has given rise to the new branch of cosmic psychology. (Author's summary) (44 references)

780
Schönpflug, W.,
and M. Schäfer
[RETENTION AND ACTIVATION DURING SUPPLEMENTARY ACOUSTIC STIMULATION] Retention und Aktivation bei akustischer Zusatsreizung.—Zeitschrift für experimentelle und angewandte Psychologie (Göttingen), 9 (3): 452-464. 1962. In German, with English summary (p. 463).

Six experimental groups were exposed to a tone of 1000 c.p.s. varying from 45 to 95 decibels during a rote learning experiment (syllables). The learning score turned out to be a third-order function of the intensity of stimulation; furthermore, there was a linear relationship between intensity of stimulation and frequency of reproduction. The differences in retention seem to reflect corresponding differences in the level of activation as measured by electrodermal resistance. Interview data suggest some hypotheses concerning the relationship between activation level and the intensity of stimulation. (Authors' summary, modified)

781
Servadio, E.
[PSYCHOLOGY OF SPACE FLIGHT] Psicologia del volo spaziale.—Ulisse (Firenze), 7: 9-16. June 1962. In Italian.

The role of psychology in the training of astronauts in the Soviet Union and in the United States is discussed. This training is concerned with the establishment of proper reactions to sensory stimuli (conditioned reflexes) as well as prevention of harmful psychological effects of sensory deprivation.

782
Shure, G. H.,
M. S. Rogers, and R. J. Meeker
GROUP DECISION MAKING UNDER CONDITIONS OF REALISTIC COMPLEXITY. —— Human Factors. 5 (1): 49-58. Feb. 1963.

The command staff in the SAGE Air Defense system was selected as a reference system for simulation. SAGE documents were flow-charted to identify rule-following situations and decision situations proper. Air defense situations were presented to subjects in the simulated environment. Four three-man teams, extensively pretrained, performed as battle staff. Transcriptions of verbalized responses, intracrew interactions and "thinking out loud", constituted the basic data for analyzing resolution behavior. Preliminary results indicated that experimental control of a complex environment is a feasible means of creating objectively defined decision situations. (From the authors' summary)

783
Taub, H. A.,
and W. H. Teichner
EFFECTS OF DIFFERENTIAL VALUE AND EXPOSURE TIME UPON THE DETECTION AND MEMORY OF SYMBOLS IN A VISUAL SEARCH TASK.—Univ. of Massachusetts, Amherst (Contract AF 19(628)-290); issued by Electronic Systems Division. Decision Sciences Lab., Bedford, Mass. (Project no. 9674, Task no. 967404). Technical Documentary Report no. ESD-TDR-63-343, June 1963. vii+48 p.

The accuracy of reporting data from briefly-exposed, multi-target symbolic displays in which the value or importance of the targets varies within the display was shown to vary inversely with the differential ratio of value of the targets. The data also suggested that (1) an increase in differential ratio does not facilitate the reporting of more important targets, but rather decreases reports of less important ones; and (2) the difference in accuracy of report to high and low valued targets varies directly with exposure time up to 2.5 sec. for the display used with 1.5 sec. as a possible optimum. The results are consistent with the hypothesis that differential value produces a selective recall from short-term memory storage. (Authors' abstract)

784
Vries, E. de
[PSYCHOLOGY OF THE FLIER] Psychologie van de vlieger. —— Nederlands militair geneeskundig tijdschrift ('s-Gravenhage), 15 (2): 48-53. Feb. 1962. In Dutch.

The learning process in flight training is discussed in view of the modern concepts of man-machine interaction. The psychologist's task encompasses not only flier selection and training, but also the flier's performance during his flying years, with particular attention given to development of such symptoms as fear of flying, flying fatigue, etc. Wartime and peacetime morale, needs, aggressivity, and motivation are factors of concern to the aviation psychologist.

785
Weiss, W.
ROLE OF THE RESPONSE SYSTEM IN A JUDGMENTAL CONTRAST EFFECT.—Perceptual and Motor Skills, 17 (1): 227-241. Aug. 1963.

Half of the subjects learned to associate nonsense syllables with a set of six line-drawn squares and half judged the relative sizes of the squares using a six-category response scale. Also, in both studies, half of each group had as the sixth square the one that immediately followed the preceding five in the geometric series and half had as the sixth one that was several removed from the common set of five in the geometric series. The very large square produced the customary contrast effect when scale judgments were required but had no effect on the paired-associative learning. The evidence suggests that the judgmental contrast effect is a result of response factors rather than perceptual changes. (Author's summary, modified)

786
Wolff, Ch. J. de,
and B. Buiten
[A FACTOR ANALYSIS OF FOUR TEST BATTERIES] Een factoranalyse van vier testbatterijen.—Nederlands Tijdschrift voor de Psychologie (Amsterdam), 18 (3): 220-239. May 1963. In Dutch, with English summary (p. 238).

This study deals with a factor analysis of 46 tests chosen from the test batteries of the Royal Netherlands Navy, the Royal Netherlands Air Force, the General Aptitude Test Battery - 1002, J. E. King's Factored Aptitude Series, R. B. Cattell's Culture

Fair Test scale 2, and the Groninger Intelligentie Test. These tests were administered to 500 regular seamen of the Royal Netherlands Navy. Two principal axis analyses were completed. The factor matrices were rotated according to the Kaiser Normal Varimax method. In the second analyses another rotation was necessary to obtain a result which is almost identical to that of the first analysis. In both analyses ten factors could be defined. (Authors' summary, modified)

b. Psychology of Personality

787
Burns, N. M.,
J. R. Moyes, and E. C. Gifford
PHYSIOLOGICAL INVESTIGATION ASSOCIATED WITH THE EVALUATION OF THE OMNI-ENVIRONMENT FULL PRESSURE SUIT: TIME ESTIMATION AND ITS PSYCHOPHYSIOLOGICAL CORRELATES. — Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Subtask no. MR005.13-1006.1). Report no. NAMC-ACEL-462, June 4, 1962. iv+[21] p.

Scores on a time estimation task were compared with five physiological indicators (heart rate, electroencephalogram, respiration rate, systolic blood pressure, galvanic skin response) and with subject's scores on the Manifest Anxiety Scale and the Minnesota Multiphasic Inventory. By using a correlation analysis and analysis of variance on the data, it was found that Galvanic Skin Response correlates the highest with time estimation. Further, it was found that the psychophysiological correlates of time estimation follow an inverted U curve, thus seeming to be an example of the arousal or activation continuum. (Authors' abstract)

788
Catell, R. B.
ADVANCES IN THE MEASUREMENT OF NEUROTICISM AND ANXIETY IN A CONCEPTUAL FRAMEWORK OF UNITARY-TRAIT THEORY. — Annals New York Acad. Sci., 93 (20): 815-839. Oct. 10, 1962.

The advances in the personality measurement made by the application of refined, multivariate experimental-statistical techniques are briefly considered focusing on the measurement of anxiety. Factor analysis of responses on questionnaires dealing with immediate introspective experience in anxiety yielded a number of primary factors considered to be sources of anxiety united in a single second-order factor. Experimental exploration of the behavioral measures of anxiety covering approximately 800 variables also gave a single general factor--unbound anxiety. Research in anxiety as a state versus a trait revealed the existence of an additional pattern of stress response--the effort stress--which is quite different from that of anxiety and is negatively correlated to the latter. The existence of two distinct response patterns clarifies some of the confusion and contradictory findings concerning the psychological associations and physiological effects of anxiety in the clinical field. The concept of the theoretical model of personality as an interacting set of unitary ability, temperament and dynamic factors, developing according to the particular properties of each, makes a more intelligible analysis and fits experimental findings and everyday-life criterion evidence better than most alternatives.

789
Ceausu, V.
[DIAGNOSIS OF EMOTIVITY IN AVIATORS] Diagnosticarea emotivităţii la aviatori. — Revista de psihologie (Bucureşti), 8 (2): 287-312. 1962. In Rumanian, with French summary (p. 311).

A review of the principal methods for investigating emotivity in aviators confirms the fact that the results obtained are not conclusive. Following a critical theoretical analysis, it is stated that: emotional manifestations can not be studied separately but together with personality; emotions should be studied in a dynamic manner; and all investigations indicate that emotions play a role in the individual's life. Emotions, considered as expressions of the relation between the individual and his environment, can be "subject" and "situation", respectively. They may appear in the following forms: (1) the subject dominated by the situation, (2) the subject dominating the situation with effort, or (3) without effort, and (4) the subject detached from the situation. In order to determine the nature of the relation between subject and situation, the following criteria are considered: the relation between mental rhythm and speed with which the situation unfolds; the subject's energy expenditure; and reaction of the subject in case of error.

790
Epstein, S.,
and W. D. Fenz
THEORY AND EXPERIMENT ON THE MEASUREMENT OF APPROACH-AVOIDANCE CONFLICT. — Jour. Abnormal and Social Psychol., 64 (2): 97-112. Feb. 1962.

Eight novice sport-parachutists were tested first on the day of a jump and again two weeks later; eight others were tested first two weeks before a jump and again on the day of a jump. Sixteen nonparachutists served as controls. The tests consisted of parallel forms of a word association test with form levels of relevance to parachuting and with a group of words related to anxiety. All 16 parachutists on both the day of a jump and the control day, and no control subjects, produced gradients of the galvanic skin response (GSR) as a function of the stimulus dimension. For all 16 parachutists the gradients were higher and steeper on the day of a jump than on a control day. Anxiety words produced greatest increase in GSR in parachutists on the day of jump, a lesser in parachutists two weeks after jump and least for controls. Parachutists produced smaller GSRs to neutral words than the controls. The results on reaction time were similar to those for GSR. The experienced parachutists reproduced a different form of curve for GSR and reaction time on the day of the jump than inexperienced parachutists. These findings are discussed relevant to predictions based on a theoretical model of approach-avoidance conflict. (From the authors' summary)

791
Lidvall, H. F.

NUEROTIC ANXIETY AND VESTIBULAR FUNCTION AS REFLECTED IN THE VERTIGO AND NYSTAGMUS RESPONSES TO REPEATED CALORIC STIMULI.—Acta oto-laryngologica (Stockholm), 56 (4): 445-456. May 1963

A routine caloric test was performed on 167 subjects with neurotic anxiety. There was no correlation between the degree of neurotic anxiety and the average intensity of the vertigo and nystagmus responses. Those subjects who had distinct vertigo responses and "normal" nystagmus responses at the routine test were selected for a study of the responses to repeated identical monolabyrinthine caloric stimulations. Among these subjects there was no correlation between the degree of neurotic anxiety and the magnitude of habituation to the stimulations. (Author's abstract, modified)

792
Norman, W. T.

VALIDATION OF PERSONALITY TESTS AS MEASURES OF TRAIT-RATING FACTORS. — Univ. of Michigan, Ann Arbor (Contract AF 41(657)-269); issued by Aerospace Medical Division. Personnel Research Lab. (6570th), Lackland Air Force Base, Tex. (Project no. 7717, Task no. 771706). Technical Documentary Report no. PRL-TDR-62-4, April 1962. v+36 p.

As the final phase of a test-development project, three forced-choice self-report tests were administered to student groups to develop empirical scales predictive of peer-nomination personality ratings drawn from the same groups. Five factor scales were developed for each test. For the independent sample of a double cross-validation analysis, all of the scales correlated positively with their criteria. Combined scales for the three tests showed usefully high correlations. Multiple regression analyses demonstrated that scores from other personality tests administered to the students did not add appreciably to prediction of the peer-nomination scores. The self-report tests yield better prediction (.38-.47) of three of the peer-nomination factors (Extroversion, Conscientiousness, Culture) than of Agreeableness (.31, .34) or Emotional Stability (.26, .29). From a second administration of the self-report tests with instructions to fake responses favorable for acceptance for officer training, detection keys were derived that identified a high percentage of faked performances, and factor scales were developed which reduced the occurrence of faked scores in the extremes of the distributions. (Author's abstract)

793
Onesti, R.,
and G. Sabatelli

[CONTRIBUTION TO THE STUDY OF THE CORNELL INDEX NO. 2 QUESTIONNAIRE] Contributo allo studio del questionario Cornell-Index n. 2. — Rivista di medicina aeronautica e spaziale (Roma), 25 (1): 37-63. Jan.-March 1962. In Italian, with English summary (p. 60).

The Cornell Index no. 2 was administered to 1200 students between 17 and 27 years of age. It consisted primarily of 101 questions aimed at evaluating the psychophysical picture of the subjects. Following a statistical analysis, the results were tabulated and a comparison made between American, French, and Italian questionnaires. The Index was found to be of value during selection procedures by screening the personality and psychosomatic disturbances of the subjects. It was also found easy to administer to large groups, with the minimum of instruction, and easy and rapid to correct.

794
Shoenberger, R. W.,
and C. S. Harris

SUBJECTIVE AND BEHAVIORAL "CERTAINTY" IN A MALE POPULATION.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-5001, Subtask 12). Report no. 3, Aug. 23, 1962. ii+5 p.

In an investigation of the generality and relationship to manifest anxiety of several tests which purport to measure subjective and behavioral "certainty", Wolff, using female subjects, obtained largely negative results. This investigation extends Wolff's study, using male subjects. Two subjective certainty measures, two behavioral certainty measures, and a manifest anxiety measure were used. Results with behavioral certainty were again essentially negative. However, unlike Wolff's results, statistically significant correlations were obtained among the subjective certainty measures and anxiety, presenting somewhat more evidence for the generality and relationship to manifest anxiety of subjective certainty among males than among females. (Authors' abstract)

795
Siegman, A. W.

FUTURE-TIME PERSPECTIVE AND THE PERCEPTION OF DURATION. — Perceptual and Motor Skills, 15 (3): 609-610. Dec. 1962.

The relation between the speed of an individual's internal clock and his future-time orientation was studied experimentally with 27 subjects. Future-time orientation scores were compiled from the median of the difference between the subject's estimate of the age at which certain events in his life may occur and his present age. Individual perception of duration was obtained from a ranking task involving metaphors of time. The results support the hypothesis that the longer the range of the subject's future-time perspective the more quickly time appears to pass.

796
Sours, J. A.,
P. Frumkin, and R. R. Indermill

SOMNAMBULISM.—Arch. General Psychiatry, 9 (4): 400-413. Oct. 1963.

An analysis is presented of the neurologic and psychiatric examinations of fourteen patients referred for somnambulism. Among these were four Aviation Officer Candidates referred for adolescent somnambulism revealed at the time of entry in the service. For comparison the Minnesota Multiphasic Personality Inventory (MMPI) was administered also to a control group of corpsmen and cadets. The results reveal that somnambulism is frequently associated with other signs of psychopathology incompatible with military service. The somnambulists scored significantly higher than controls on 9 out of 14 scales on the MMPI. In this group 35% were overt schizophrenics and 28% were markedly schizoid in personality configuration. The remainder were chiefly neurotic character disorders. The etiology of somnambulism is discussed and its significance in military psychiatry is emphasized. (53 references)

797
Strollo, M.
[CHARACTEROLOGICAL EVALUATION BY MEANS OF THE MIRROR IMAGE TEST BEFORE AND AFTER CONFINEMENT] Valutazione caratterologica mediante il test dell'immagine speculare prima e dopo prova di confinamento.—Rivista di medicina aeronautica e spaziale (Roma), 26 (1): 71-79. Jan.-March 1963. In Italian, with English summary (p. 76-77).

Young persons (20-25 years of age) were subjected to a psychomotor test (mirror drawing test) before and after a period of confinement during which sensory, perceptive and motor stimuli were lacking, in order to evaluate character traits such as emotional stability, inclinations, etc. Most subjects displayed changes in affective-emotional reactions. The results, however, cannot be expressed as objective and mechanical data. The mirror drawing test may be of value as a psychodiagnostic test in the field of selection and orientation.

798
Willingham, W. W.,
and R. K. Ambler
THE RELATION OF THE GORDON PERSONAL INVENTORY TO SEVERAL EXTERNAL CRITERIA.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3003, Subtask 1). Report no. 34, May 28, 1962. ii+5 p.

This investigation studied the relationship between four personality traits as measured by the Gordon Personal Inventory (GPI) and several external criteria consisting of peer nominations of the same traits. Peer nominations and GPI scores for 208 naval aviation cadets divided into 11 sections of unequal size were analyzed. Three of the GPI scales showed moderate correlations with external criteria. A fourth was not significantly correlated with a criterion which it supposedly should predict well. Implications of the findings are discussed. (Authors' abstract)

c. Social Psychology

799
Church, R. M.
THE EFFECTS OF COMPETITION ON REACTION TIME AND PALMAR SKIN CONDUCTANCE. —— Jour. Abnormal and Social Psychol., 65 (1): 32-40. July 1962.

Ninety-two subjects were tested on reaction time tasks under normal and competitive conditions. The speed of the simple reaction and of the discriminative reaction increased under the competitive condition. Although the competitive condition resulted in differential reinforcement for fast responses, this differential reinforcement could not account for the increased speed of response since the increased speed was as apparent on the first trial as on any later trials. Under the competitive condition, the level of palmar skin conductance increased and self-rated alertness increased, but these measures were not related to the decrease in reaction time. Thus the speed of performance and some measures of the level of motivation both increased in a competitive situation, but there was no evidence in these experiments for a causal relationship between them. (Author's summary)

800
Sells, S. B.
MILITARY SMALL GROUP PERFORMANCE UNDER ISOLATION AND STRESS: CRITICAL REVIEW. V. PSYCHOLOGICAL PRINCIPLES OF MANAGEMENT AND LEADERSHIP. —— Texas Christian Univ., Fort Worth (Contract AF 41(657)-323); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8243-11). Technical Documentary Report no. AAL-TDR-62-35, June 1962. iv+43 p.

A critical discussion and interpretation are presented of principles of leadership and management with particular reference to the problems of Aircraft Control and Warning sites in Alaska. It is based primarily on a review of scientific research in the fields of psychology, sociology, and management science. The major topics covered include relations of management and leadership, group-centered vs. production-centered management, organizational relations, organizational control, and leadership in formal organizations. Selected references are cited and reference is made to an annotated bibliography containing abstracts of significant studies. (Author's abstract) (31 references)

d. Psychiatry

[*Neuropsychiatric examination under 8-f*]

801
Eisele, V. G.,
and J. J. Higgins
HYPNOSIS IN EDUCATIONAL AND MORAL PROBLEMS. —— Amer. Jour. Clinical Hypnosis, 4 (4): 259-263. April 1962.

This paper summarizes the different counseling problems encountered over a fifteen-year period. Of particular interest are the examples in which different hypnotic techniques were successful in relieving a fear of flying.

e. Alertness and Vigilance

802
Adams, J. A.
EXPERIMENTAL STUDIES OF HUMAN VIGILANCE. —Univ. of Illinois, Aviation Psychology Lab., Urbana (Contract AF 19(604)-5705); issued by Electronic Systems Div. Operational Applications Lab., L. G. Hanscom Field, Bedford, Mass. (Project no. 9878, Task no. 967803). Technical Documentary Report no. ESD-TDR-63-320, Feb. 1963. vi+35 p.

A series of experiments was conducted on human vigilance or the characteristics of long-term human attentiveness for the occasional occurrences of signals which were to be detected and reported. Emphasis was given complex visual displays with multiple stimulus sources and alpha-numeric signals of the general class found in semi-automatic man-machine systems. The results were that: (1) vigilance decrement usually occurs in small but reliable amounts within a session but does not increase as a function of number of daily sessions, (2) only response-produced stimuli from simple decision behavior were a source of stimulation that deterred vigilance decrement in accord with the arousal hypothesis, (3) temporal uncertainty was not associated with differential vigilance decrement although spatial uncertainty appeared to by under some circumstances, and (4) feedback about the operator's proficiency after each response was a training method that improved monitoring behavior in a stable manner. Recommendations for designers and users of man-machine systems are given. (From the author's abstract) (35 references)

803
Angiboust
[ESTIMATION OF BRIEF DURATIONS: MEANS OF STUDY OF THE STATE OF VIGILANCE OF THE ORGANISM, ITS VALUE IN AVIATION BIOLOGY]
L'estimation des durées brèves: Moyens d'études de l'état d'éveil de l'organisme, son intérêt en biologie aéronautique.—Revue de médecine aéronautique (Paris), 1 (3): 47-50. March-April 1962. In French.

The state of vigilance of ten subjects was tested by means of a monotonous surveillance task administered over a two-hour period, by having the subjects estimate the length of one second and measuring their reaction times to some of various stimuli (sound and red, white, and green lights) which were presented at intervals varying from four seconds to four minutes. Tables are presented of the coefficients of variability of the time estimations before and after presentation of the vigilance test. Examination of the coefficients revealed no systematic variation between the beginning and the end of the surveillance task. Estimation of the length of one second, however, appears to reflect the state of the body's physiological vigilance. Estimation lengthens as the state of vigilance decreases. This test is considered of value in the field of aviation and astronautic biology where the problems of measuring the state of vigilance are most acute.

804
Bakan, P.
and R. Manley
EFFECT OF VISUAL DEPRIVATION ON AUDITORY VIGILANCE.—Brit. Jour. Psychol. (London), 54 (2): 115-119. May 1963.

Signal detection in an auditory vigilance task is compared under conditions of normal visual stimulation and of visual deprivation produced by a blindfold. The task consists of detecting sequences of three different digits in the order odd-even-odd, appearing in a continuous series of digits. Sighted males detect significantly fewer signals than blindfolded males. The visual deprivation variable has no significant effect on female performance. There is some evidence from retrospective reports that sighted males are more emotional and perhaps aroused to a point which impairs efficient vigilance performance. (Authors' summary)

805
Baker, C. H.
PROBABILITY OF SIGNAL DETECTION IN A VIGILANCE TASK. — Science (Washington), 136 (3510): 46. April 6, 1962.

Eighty-six female subjects were exposed to eight signals over a period of 32 minutes at inter-signal intervals of 0.5 to 7.5 minutes. A ninth signal was given at an interval of 0.25 to 10 minutes. The task was to detect a 0.30 second stoppage of a large clock hand. The results show that the detection is a function of the interval length between the last programmed signal and the test signal. The probability of detection is then greatest when the signal is given following an interval which is equivalent to the mean of the inter-signal intervals preceding the interval in question.

806
Baker, R. A.,
J. R. Ware, and R. R. Sipowicz
SUSTAINED VIGILANCE. I. SIGNAL DETECTION DURING A 24-HOUR CONTINUOUS WATCH.—Psychol. Record, 12 (3): 245-250. July 1962.

Two groups of 10 subjects each monitored brief interruptions of a continuous light source for 24 consecutive hours. The vigilance decrement was found to be similar to that usually noted in shorter watch sessions—a general decrease in detection with time on watch. Seven of the 20 subjects remained awake for the entire watch session, one detecting 81.3% of the signals presented. An analysis of individual detection curves revealed periodic and partial recovery effects of short duration. The results also suggest that the extent of time on watch determines the efficiency of detection—this efficiency being lowest after 16 to 18 hours of continuous watch. It was also noted that the subjects did not suffer as rapid a decrement as might have been expected on the basis of previous research. (Authors' summary)

807
Baker, R. A.,
J. R. Ware, and R. R. Sipowicz
VIGILANCE: A COMPARISON IN AUDITORY, VISUAL, AND COMBINED AUDIOVISUAL TASKS. — Canad. Jour. Psychol. (Toronto), 16 (3): 192-198. Sept. 1962.

Six groups of subjects, twenty to a group, monitored brief interruptions of a continuously presented sound or light source for a three-hour period. One group, the redundant signal group, received 72 combined audio-visual signals; a second group received 72 visual signals; a third group 72 auditory signals; a fourth group, the non-redundant group, received 72 signals – 36 auditory and 36 visual – separated so that no two signals from different sensory modes occurred at the same time; the fifth and sixth groups received 36 visual and 36 auditory signals respectively. There were no statistically significant differences between the first three groups in the percentage of signals detected. An analysis of the detections made by the non-redundant groups showed there was no intersensory interaction or arousal of an intensity sufficient to affect the detection probabilities. It was also noted that subjects on the lower signal rates detected more of the signals than subjects at the higher rates. (Authors' summary, modified)

808
Bergum, B. O.,
and D. J. Lehr
VIGILANCE PERFORMANCE AS A FUNCTION OF PAIRED MONITORING. — Jour. Applied Psychol., 46 (5): 341-343. Oct. 1962.

Two experiments were performed to determine the effect of pairing of observers upon individual monitoring performances. Both studies employed two groups of 20 subjects each. One group consisted of paired monitors and the other of isolated monitors. Experiment I employed a rate of 24 signals/hour, Experiment II employed 6 signals/hour. All subjects monitored a circular light display for a period of 90 minutes. Neither experiment indicated an over-all facilitation of performance resulting from pairing, but both demonstrated significant relationships between performances of the members of the pairs. It was hypothesized that the degree of conversational interaction between members of the pairs might account for the observed effect. (Authors' summary)

809
Bergum, B. O.,
and D. J. Lehr
EFFECTS OF AUTHORITARIANISM ON VIGILANCE PERFORMANCE.—Jour. Applied Psychol., 47 (1): 75-77. Feb. 1963.

An experiment was performed on the effects of authoritarian monitoring conditions upon vigilance performance. Two groups of 20 subjects each were employed. One group worked at a light monitoring task for a period of 135 minutes without rest and alone. The second group worked at the same task for the same amount of time but was observed by either a commissioned or noncommissioned officer according to a random visiting schedule. Signal rate was 12 signals per hour. The results indicated a highly significant facilitation of detection performance resulting from observation by the officers. It was suggested that these conditions represent an extreme point along a dimension of perceived threat to the monitor. (Authors' summary)

810
Bergum, B. O.,
and D. J. Lehr
END-SPURT IN VIGILANCE.—Jour. Exper. Psychol., 66 (4): 383-385. Oct. 1963.

An experiment was performed to test the hypothesis that an end-spurt effect would be demonstrated in a vigilance situation when subjects had knowledge of both length of the vigil and present point in the vigil. Two groups of 20 subjects each were tested on a visual vigilance task for 135 min. One group had knowledge of the length and present point in the vigil and the second group did not. Analysis of the data indicated a statistically significant improvement in performance for the first group and no change in performance for the second group in the final period of testing. (Authors' summary)

811
Boulter, L. R.,
and J. A. Adams
VIGILANCE DECREMENT, THE EXPECTANCY HYPOTHESIS, AND INTERSIGNAL INTERVAL.—Canad. Jour. Psychol. (Toronto), 17 (2): 201-209. June 1963.

An experiment was performed to investigate the influence of temporal uncertainty of signals on the development of vigilance decrement. Subjects were required to detect a two-digit number that occurred 48 times in three hours at a small display box. Each signal lasted for 5 seconds, and response latency was the performance measure. Each of three groups had a different degree of temporal uncertainty in their signal series. There were 20 subjects in a group. All subjects were given a practice and a criterion session on different days. Overall, the three groups developed significant performance decrement during the three-hour criterion session, but the three degrees of temporal uncertainty did not differentially influence the decrement. An analysis of performance as a function of intersignal intervals for each group suggested that the functions presently hypothesized for temporal expectancy states in vigilance tasks are oversimplified. (Authors' summary)

812
Broadbent, D. E.,
and M. Gregory
DIVISION OF ATTENTION AND THE DECISION THEORY OF SIGNAL DETECTION.—Proc. Royal Soc., series B, Biol. Sci. (London), 158 (971): 222-231. Sept. 17, 1963.

Ten men were asked to listen to bursts of noise which were presented to one ear, and which might or might not contain a tone. The other ear received 6-digit numbers simultaneously. The listeners reported their degree of confidence that a tone was present; in one condition they ignored the numbers and in another condition they had to report them as well as their judgment about the tone. In the latter condition they reported the tone with confidence slightly less often when it was present, but also reported it more often when it was in fact absent. Analysis of the results, by a model which supposes the brain to detect signals by a statistical decision, shows that one parameter, β, is unchanged by division of attention. This parameter measures the subjective probabilities and values associated with signal as opposed to nonsignal. Another parameter, d', changes when attention is divided. This quantity measures the strength of the signal relative to the random variation within the system. It is concluded that diversion of attention away from a stimulus produces an effect resembling a reduction in the intensity of the stimulus. The ignored event is therefore not blocked altogether and under suitable conditions may nevertheless produce a response from an observer. (Authors' abstract)

813
Brown, D. W.
THE EFFECT OF OBSERVER REDUNDANCY ON DISPLAY MONITORING EQUIPMENT.—Jour. Psychol., 56 (2): 413-419. Oct. 1963.

The study investigated speed and reliability of performance by pairs of human operators as a function of operator redundancy and task difficulty. Six pairs of subjects responded to three sets of 4 critical stimuli composed of either two, three, or four lights in a 4 x 3 matrix of lights; the 12 "critical stimuli" were randomly placed in a total set of 48 stimuli. In the redundant operation, both subjects responded to all four "critical stimuli" with the fastest response of the two being recorded. In the nonredundant situation, each subject responded to two of the four "critical stimuli." All subjects served under all experimental conditions with the order of presentation of conditions counterbalanced between groups. The results substantiated the hypothesis that reaction time would decrease with decreasing stimulus complexity and that the nonredundant situation would produce a lower reaction time than the redundant condition. (Author's summary, modified)

814
Faulkner, T. W.
VARIABILITY OF PERFORMANCE IN A VIGILANCE TASK. —Jour. Applied Psychol., 46 (5): 325-328. Oct. 1962.

An experiment was conducted to determine the effect of signal pattern and frequency on the variability of a subject's performance in a vigilance task. Subjects were 12 male college students who watched 3 dials during 3 consecutive 27-min. periods. Real signals occurred alone in one period while two different patterns of dummy signals were added in the other two periods. It was found that dummy signals which occurred at semiregular intervals were more effective in reducing the subject's variability than those which occurred at nonregular intervals. It was also found that variability increased with time. It is concluded that use of a semiregular pattern of dummy signals would be one way of improving performance on a vigilance task. (Author's summary)

815
Frankmann, J. P.,
and J. A. Adams
THEORIES OF VIGILANCE.—Psychol. Bull., 59 (4): 257-272. July 1962. DLC (BF1.P75, v. 59)

Vigilance research is reviewed with respect to the different types of models formulated and their effectiveness in accounting for the experimental data. The chief models evaluated are: (1) inhibition hypothesis (Mackworth), (2) attention hypothesis (Broadbent), (3) expectancy hypothesis (Deese, Baker), and (4) sensory variation or activationist hypothesis. The main shortcoming of these theories lies in the loose formulation which makes testing of implications difficult. (52 references)

816
Haider, M.
[EXPERIMENTAL INVESTIGATIONS OF CONTINUOUS ATTENTION AND CEREBRAL VIGILANCE IN MONOTONOUS TASKS] Experimentelle Untersuchungen über Daueraufmerksamkeit und cerebrale Vigilanz bei einförmigen Tätigkeiten.—Zeitschrift für experimentelle und angewandte Psychologie (Göttingen), 10 (1): 1-18. 1963. In German, with English summary (p. 15-16).

Vigilance tests conducted in an industrial setting by means of a special chronograph in the course of the work showed a tendency toward an increase in nonobserved signals and a prolongation of reaction time with observed signals. Around the middle of the shift, there occurred a leveling-off of this trend, and towards the end the vigilance performance often improved. Accordingly, attentiveness varied in the course of uniform activities in a manner corresponding to the monotony hypothesis. The curves were quite variable and individually different; however, with respect to the described changes in the course of the work, there were significant, although low, correspondences. With one group of subjects carrying out non-rhythmical, attention-demanding work no progressive impairment of performance on the simultaneously administered vigilance tests could be determined. This might indicate that increasingly demanding tasks are able to cancel out monotony effects. The frequency of nonobserved signals and the length of reaction time for observed signals correlated only slightly and insignificantly. Thus they form largely independent criteria of vigilance performance. (Author's summary) (39 references)

817
Harris, C. S.,
and R. N. Haber
SELECTIVE ATTENTION AND CODING IN VISUAL PERCEPTION. — Jour. Exper. Psychol., 65 (4): 328-333. April 1963.

The form of a subject's silent verbal encodings of briefly presented stimuli was manipulated. Order of encoding accounted for the effects of instructions to attend selectively on accuracy of report. Instruction to attend selectively had no significant effect on subjects who encoded the stimulus in the order dictated by English syntax. The subjects whose coding strategy permitted them to encode first the stimulus attribute they were told to attend to reported this attribute more accurately than incidental attributes. The superior accuracy was not a by-product of order of report. The attribute encoded first was based on a better visual trace and also was retained better in short-term memory. (Authors' summary)

818
Kirk, R. E.,
and E. Hecht
MAINTENANCE OF VIGILANCE BY PROGRAMMED NOISE.—Perceptual and Motor Skills, 16 (2): 553-560. April 1963.

This research was designed to compare the relative effect of three environmental conditions on the performance of a simple vigilance task. The vigilance task consisted of a cathode ray tube display which was monitored by 30 subjects for two hours. Three environmental conditions were randomly introduced while subject monitored the display. The conditions were a constant noise of 64.5 decibels, a variable noise having an average sound pressure level of 64.5 decibels, and a quiet condition of 61 decibels. The results indicate that the probability of signal detection is higher for the variable noise condition than for the constant noise and quiet conditions. No difference in probability of detection was found between the latter two conditions. An explanation for the facilitating effect of sensory stimulation on vigilance is sought in terms of the alerting and general arousal effects attributed to the reticular activating system. (Authors' summary)

819
Loeb, M.,
and E. A. Schmidt
A COMPARISON OF THE EFFECTS OF DIFFERENT KINDS OF INFORMATION IN MAINTAINING EFFICIENCY ON AN AUDITORY MONITORING TASK.—
Ergonomics (London), 6 (1): 75-81. Jan. 1963.

Eight subjects were required to respond as rapidly as possible to brief, infrequent, randomly occurring auditory signals over eight fifty-minute sessions. In four of the sessions, the sensation level of the signals was 10 decibels and in four, 60 decibels above the threshold. The experimental conditions were: (a) feedback information about performance on each signal, (b) misleading feedback information about performance, and (c) acknowledgment of the response without any information about the performance. Latency and failures to respond under those conditions were compared with comparable measures under control conditions without feedback information or acknowledgment. The latency remained fairly constant and failures of detection were negligible for all conditions in which subjects were responding to 60-db. signals. Reaction times for 10-db. signals increased significantly in the control condition and when the subject's responses were merely acknowledged. The increase was significantly less when subjects were given simulated information uncorrelated with their responses. When true knowledge of results was given, no increase of latency occurred. No systematic trend for failures of detection was noted. Possible interpretations of the findings are discussed. (Authors' summary, modified)

820
McCormack, P. D.
A TWO-FACTOR THEORY OF VIGILANCE. —
Brit. Jour. Psychol. (London), 53 (4): 357-363. Nov. 1962.

The findings of seven studies on reaction time are related to those of the more conventional vigilance setting, discussed with respect to existing theories of vigilance and integrated within an inhibition-motivation framework. (Author's summary)

821
Mackworth, J. F.
THE EFFECT OF INTERMITTENT SIGNAL PROBABILITY UPON VIGILANCE.—Canad. Jour. Psychol. (Toronto), 17 (1): 82-89. March 1963.

Signals were presented in a vigilance task, using a clock with alternate black and white segments. It was found that when subjects were told that signals would occur only on the black segments they detected more signals than when they expected them anywhere on the clock face. However, the rate of decrement in performance was not affected by the different locations of the signals, nor did the addition of extra signals reduce the rate of decrement. (Author's summary)

822
Mackworth, J. F.
EFFECT OF REFERENCE MARKS ON THE DETECTION OF SIGNALS ON A CLOCK FACE.—
Jour. Applied Psychol. 47 (3): 196-201. June 1963.

Forty-two female subjects were employed in each of three studies undertaken to determine the effect of white marks on a black clock face on the detection of signals, consisting of brief pauses of the clock hand. The signals were presented at intervals ranging from 5 to 14 seconds; 0-30 marks were used. The addition of one mark reduced the percentage of missed signals to half that of the blank face ($p<0.01$). Least signals were missed when they were near the white mark. Conclusions are that the detection of a brief pause in a clock hand is improved by the addition of reference marks and there is a rapid decrease in detection of frequent signals as the run continues. (Author's summary)

823
Micko, H. C.
[ON THE USE OF TWO OBSERVERS IN SUSTAINED VIGILANCE TASKS] Über den Einsatz zweier Beobachter bei Dauerbeobachtungstätigkeiten.—
Zeitschrift für experimentelle und angewandte Psychologie (Göttingen), 10 (1): 35-45. 1963. In German, with English summary (p. 43-4).

With tasks involving sustained vigilance the use of a second observer can reduce the probability that signals are overlooked. Several uses of a second observer were compared in this study. Various programs in which observers relieved one another showed no improvement in performance as compared with the uninterrupted activity of a single man. This may have been due to the fact that under the conditions of the experiment individual observers showed no diminution of vigilance in the course of the 1-1/2 hour experiment. Two observers working simultaneously detected more signals than a single observer. The increase in probability of detection is equally large whether the observers perform together or independently of each other. However, the probability is less than might be expected if one assumes that the momentary observation performances of the two observers do not correlate over a period of time. (Author's summary)

824
Monty, R. A.
EFFECTS OF POST-DETECTION RESPONSE COMPLEXITY ON SUBSEQUENT MONITORING BEHAVIOR.—Human Factors, 4 (4): 201-207. Aug. 1962.

This paper examines the effect of the complexity of the post-detection response demands on subsequent monitoring performance at two rates of target presentation. Three conditions requiring differentially complex post-detection responses were compared with a baseline condition in which no post-detection demands were made (save the simple detection-indicating response). The results indicated that two of the three complex conditions were accompanied by significantly less decrement in performance than that found in the baseline condition. The third was not significantly different from the baseline condition. "Arousal theory" could account for the results on the basis that there exists an optimal level of cortical arousal stemming from sensory variation provided by a task. If this hypothetical level is not reached or exceeded, a decrement in performance is to be expected. No clear answer was provided regarding an interaction

between effects attributable to signal rate with effects attributable to response complexity.
(Author's abstract)

825
Mulholland, T.,
and S. Runnals
INCREASED OCCURRENCE OF EEG ALPHA DURING INCREASED ATTENTION. —— Jour. Psychol., 54 (2): 317-330. Oct. 1962.

The occurrence of alpha rhythm in the electroencephalogram was compared during continuing attention sets and during recurring alerting responses. Alpha was frequently facilitated during periods of attention sets or was little affected. On the other hand, the familiar suppressions of alpha occasioned by alerting to an external signal was clearly evident. The behavioral effects of both the attention sets (on perceptual content) and alerting (giving a verbal report in response to an audible signal) were definite and consistent. It is concluded that the term attention can refer to neither a qualitatively consistent behavioral nor neurophysiological entity and that the classical and familiar alpha-attention hypothesis refers to a special case, i.e., transitory alerting to an external signal. (Authors' summary)

826
Osborn, W. C.,
R. W. Sheldon, and R. A. Baker
VIGILANCE PERFORMANCE UNDER CONDITIONS OF REDUNDANT AND NONREDUNDANT SIGNAL PRESENTATION. —— Jour. Applied Psychol., 47 (2): 130-134. April 1963.

Brief interruptions in a sound, a light, or both the sound and light, were monitored by 41 subjects over a 3-hour period. A dual response apparatus allowed the subjects to report the light signals, the sound signals, or both. The detection rate was found to be significantly better for the redundant signals than for either alone. While the detectability of each component of the redundant signal was comparable to its corresponding single mode, a systematic deviation in the bimodal curve--from predicted to observed--was noted. It is concluded that the weaker component of a redundant signal contributes significantly to the overall detectability, and the use of dual channel displays in applied vigilance situations is justified. (Authors' summary)

827
Pope, L. T.
ATTENTION LEVEL AND VISUAL AND AUDITORY MONITORING PERFORMANCE. —— Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718406). Technical Documentary Report no. AMRL-TDR-62-97, Aug. 1962. iii+20 p.

The relationship between performance on a monitoring (vigilance) task and level of alertness as measured by performance on a tracking task was investigated. Each of 20 male college subjects was tested under each of ten experimental conditions. The experimental conditions consisted of various combinations of: auditory or visual monitoring; low or high rate of signal input; auditory or visual tracking; and simple or complex tracking problems. The results indicate that for the visual vigilance conditions more signals were missed when the subject was simultaneously engaged in a tracking task; however, this was not true for the auditory vigilance conditions. On both the visual and auditory vigilance tasks the decrement in performance during the 45-minute test period was less when a tracking task was performed simultaneously. Furthermore, the better the subject tracked, or the more frequent the vigilance signals, the greater the likelihood of a signal being detected. (Author's abstract)

828
Pope, L. T.,
and D. F. McKechnie
CORRELATION BETWEEN VISUAL AND AUDITORY VIGILANCE PERFORMANCE.—Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718406), Technical Documentary Report no. ARML-TDR-63-57, July 1963. iii+6 p.

Each of 40 male college subjects participated in two 35-minute test trials, one visual and one auditory. In each 35-minute trial five randomly spaced vigilance signals were presented. Various indices of correlation computed from the data obtained in this study show no relationship between auditory and visual vigilance performance. The percentage of signals detected is probably affected by sensory acuity factors; however, the data of this study did not provide a test of this hypothesis. Other studies should be conducted, comparing the decrement in detection efficiency rather than the percentage of total signals detected. This suggested measure should be less sensitive to sensory acuity components of vigilance than the over-all percentage detection measures used in this study. (From the authors' abstract)

829
Sipowicz, R. R.,
J. R. Ware, and R. A. Baker
THE EFFECTS OF REWARD AND KNOWLEDGE OF RESULTS ON THE PERFORMANCE OF A SIMPLE VIGILANCE TASK.—Jour. Exper. Psychol., 64 (1): 58-61. July 1962.

Four groups of subjects, 20 subjects in each, monitored aperiodic and brief interruptions of a continuous light source under isolated conditions for a three-hour period. The subjects in Group R received a monetary reward which was decreased according to the number of signals missed. Group KR was informed of all signals missed by a bright flash of light Group R + KR received both the knowledge of results and reward according to the schedule for Group R. Group C, a control, received neither the reward nor the knowledge of results. Although all experimental groups were significantly better than the control group, the combination of reward and the knowledge of results produced the highest level of signal detection. The results are interpreted as indicating that either reward or KR produced the highest level of signal detection. The effectiveness of reward, however, is highly dependent upon the manner in which it is used. The effectiveness of such incentives in improving performance and reducing inter-subject variability also attenuated the importance previously assigned to individual differences. It is further suggested that such differences are primarily motivational and, as such, are susceptible to experimental manipulation and control. (Authors' summary, modified)

830
Teichner, W. H.
PROBABILITY OF DETECTION AND SPEED OF RESPONSE IN SIMPLE MONITORING.—Human Factors, 4 (4): 181-186. Aug. 1962.

Two simple monitoring experiments were performed to study the dependence of probability of detection and of speed of response to detected signals on the initial probability of detection of the signal established psycho-physically and on duration of the task. The results indicated that: (1) detection during the task is directly related to the probability of signal detection before the task and inversely related to length of watch, and (2) the speed of response to those signals which are detected is directly dependent on the probability of detection before the watch but independent of factors which operate during the watch. (Author's abstract)

831
Weidenfeller, E. W.,
R. A. Baker, and J. R. Ware
EFFECTS OF KNOWLEDGE OF RESULTS (TRUE AND FALSE) ON VIGILANCE PERFORMANCE. — Perceptual and Motor Skills, 14 (2): 211-215. April 1962.

Seventy-nine subjects divided among four groups monitored a simple visual display for a 3 hour period. Twenty subjects were assigned to a control group, 20 to an irrelevant stimulus (IS) group, 19 to a knowledge of results (KR) group, and 20 to a "false" knowledge of results (FKR) group. The signal, presented on a 24-per-hour variable schedule, was a brief interruption of a continuous light. For the KR, FKR, and IS groups a second white light was used to provide knowledge of results, false knowledge of results, and additional irrelevant stimulation. A comparison of the detection performance showed a significantly higher probability for both knowledge of results groups. No significant difference was obtained between the IS and the control groups or between the KR and FKR groups. The results are discussed in terms of previous findings. (Authors' summary)

832
Wiener, E. L.
NOTE: ON THE PROBABILITY OF DETECTION OF A SIGNAL BY MULTIPLE MONITORS. — Psychol. Record, 13 (1): 79-81. Jan. 1963.

In attempting to evaluate the probability that at least one member of a multi-man team will detect a signal, one must avoid the assumption that the probabilities of the individual monitors detecting the signal are independent. Such an assumption is probably unjustified, and the use of the multiplicative rule for combining independent probabilities will lead to false conclusions regarding the benefits of increasing the number of monitors on a team. (Author's summary)

833
Wiener, E. L.
KNOWLEDGE OF RESULTS AND SIGNAL RATE IN MONITORING: A TRANSFER OF TRAINING APPROACH.—Jour. Applied Psychol., 47 (3): 214-222. June 1963.

This study investigated the transfer effects of training with three signal rates and three levels of knowledge of results (KR) in a visual monitoring task. Each subject monitored for 48 min. under one of 9 signal rate-KR conditions on Day 1. On Day 2 all subjects monitored under the medial signal rate with no KR. Results show: (a) on Day 1 mean probability of detection increased with signal rate and amount of KR, (b) these differences persisted on Day 2 when KR was withdrawn, and (c) commissive errors were higher with partial KR than with either full KR or none. It is concluded that training a monitor with KR and high signal rates may improve performance when he must monitor with low signal rates and no feedback. (Author's summary) (28 references)

6. BIOLOGICAL, PHYSIOLOGICAL, AND PSYCHOLOGICAL EFFECTS OF ENVIRONMENTAL FACTORS AND STRESSES

a. General

834
Abeleva, E. A.,
G. P. Parfenov, and IU. A. Lapkin
[CROSSING-OVER IN MALE DROSOPHILA MELANOGASTER, INDUCED BY COSMIC FLIGHT FACTORS] Krossingover u samtsov Drosophila melanogaster, vyzvannyi faktorami kosmicheskogo poleta. — Iskusstvennye sputniki zemli (Moskva), 13: 119-122. 1962. In Russian.

The incidence of diploid cell mutations in hybrid males of *Drosophila melanogaster* was evaluated after flights in Sputnik-5, Vostok-1 and -2, and after exposure to low- and high-frequency vibrations in the laboratory. The mutations decreased progressively in the following order: low-frequency vibration (for 2 hours), Sputnik-5, low-frequency vibration (for 30 minutes), Vostok-1, Vostok-2, high-frequency vibration. Mutations actually were absent in the last two instances. Mutations resulting from the flight on Sputnik-5 could not be attributed to cosmic radiation, because it was too insignificant to produce such changes. It can be concluded that low-frequency vibration can induce mutations, and that there is a linear relation between their frequency and the duration of vibration.

835
Agadzhanian, N. A.,
and A. R. Mansurov
[THE EFFECT OF HYPOXIA AND PROLONGED RADIAL ACCELERATIONS ON THE ANIMAL ORGANISM] Vliianie na organizm zhivotnykh kislorodnogo golodaniia i dlitel'nykh radial'nykh uskorenii. — Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 53 (4): 42-46. April 1962. In Russian, with English summary (p. 45-46).

Conditioned motor, respiratory, and cardiovascular reflex reactions were studied in dogs at simulated altitudes ranging from 2,000 to 10,000 m. An X-ray study was also made of the changes in the position of organs in the thoracic area in relation to various g values during acceleration on a centrifuge. In hypoxia at simulated altitudes of 6000-9000 m. the vegetative components of the conditioned reflexes were almost completely depressed and replaced by the unconditioned ones as manifested by intensification of the respiratory function and cardiac activity. At altitudes above 9000 m. the cardiac and respiratory functions were markedly disturbed and periodic breathing and cardiac arrhythmia appeared. Action of the centripetal forces in the head-tail direction resulted in a reduction of the size and intensity of the cardiac shadow, as well as a shift in the position and deformation of the internal organs. The character and the extent of the changes in the roentgenological picture of internal organs is a function of the value and duration of the accelerative forces and of the initial functional state of the central nervous system. (Authors' summary, modified)

836
Alekseeva, O. G.,
and A. P. Volkova
[THE INFLUENCE OF COSMIC FLIGHT ON IMMUNOLOGICAL REACTIVITY OF THE ORGANISM] Vliianie faktorov kosmicheskogo poleta na immunologicheskuiu reaktivnost' organizma. — Problemy kosmicheskoi biologii (Moskva), 1: 181-189. 1962. In Russian, with English summary (p. 189).

A study was made of immunological reactivity (bactericidal properties of the skin and phagocytic properties of the blood) in dogs. The animals were exposed to various stresses: flight in high-altitude rockets and on sputniks; vibration (70 c.p.s., 0.4 mm. amplitude, 13 minutes); and centrifuge rides (2-12 g). The immunological reactivity could change even after a single vibratory or centrifuge test. After space flights, moderate changes occurred as evidenced by disturbances of the autoflora of the skin and of the buccal cavity. The changes in reactivity are, apparently, adaptation reactions to the sum total of extraneous physical factors.

837
Anet, P.,
and A. Delescluse
[CONTROL OF CHOLESTEROL AND LIPOPROTEINS IN FLYING PERSONNEL: BRIEF NOTES ON THE EFFECT OF STRESS ON THE CHOLESTEROL LEVEL] Contrôle du cholestérol et des lipoprotéines chez le personnel navigant: brèves remarques sur l'influence du stress sur le taux du cholestérol. — Revue de médecine aéronautique (Paris), 1 (4): 75-77. July-Aug. 1962. In French.

Four cases, selected from observations made in 1958, are reported to demonstrate the effect of stress on the blood cholesterol level of pilots. These cases are partial and insufficient. The systematic control of cholesterolemia in flying personnel is advocated, since the excess levels of blood cholesterol found with stress may constitute one of the objective symptoms of simple fatigue, overwork, and stress.

838
Antipov, V. V.,
R. M. Baevskii, O. G. Gazenko, A. M. Genin, A. A. Giurdzhiian, N. N. Zhukov-Verezhnikov, B. A. Zhuravlev, L. I. Karpova, G. P. Parfenov, A. D. Seriapin, E. IA. Shepelev, and V. I. Iazdovskii
[SOME CONCLUSIONS OF MEDICO-BIOLOGICAL STUDIES CARRIED OUT IN SPUTNIKS 2 and 3] Nekotorye itogi mediko-biologicheskikh issledovanii na vtorom i tret'em kosmicheskikh korabliakh-sputnikakh.—Problemy kosmicheskoi biologii

(Moskva), 1: 267-284. 1962. In Russian, with English summary (p. 284).

The paper deals in a broad sense with problems of maintenance of suitable atmospheric conditions in a space craft and with nutritional aspects. Physiological, biochemical, and cytological studies carried out during and after the flights of Sputniks 2 and 3 are reviewed. The authors conclude that only orbital flights can supply sufficient data concerning actual conditions in interplanetary space.

839
Apanasenko, Z. I.,
and M. A. Kuznetsova
[THE DELAYED EFFECT OF SPACE FLIGHT UPON THE VESTIBULAR-TONIC AND FLEXOR REFLEXES IN THE GUINEA PIG] Otdalennoe deistvie kosmicheskogo poleta na vestibulo-tonicheskii i fleksornyi refleksy morskoi svinki.—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1963 (2): 214-221. March-April 1963. In Russian, with English summary (p. 221).

One guinea pig was studied 1.5 months prior to and for 15 days after an orbital flight in Sputnik-IV. On the second day after the flight, an increase of spontaneous electrical activity of the hind limb muscles was observed. The latent period of electromyographic reaction to an adequate stimulus of the vestibular apparatus decreased, while the duration of the aftereffect increased. No significant changes were noted in the latent period of the defense flexor reflex.

840
Arsen'eva, M. A.,
V. V. Antipov, V. G. Petrukhin, T. S. L'vova, N. N. Orlova, and S. S. Il'ina
[CHANGES IN MAMMALIAN HEMATOPOIETIC ORGANS CAUSED BY FLIGHT IN SPUTNIK-2] Izmeneniia v krovetvornykh organakh mlekopitaiushchikh pod vliianiem poleta na 2-m korablesputnike.—Problemy kosmicheskoi biologii (Moskva), 1: 205-218. 1962. In Russian, with English summary (p. 217-218).

Forty mice were used in the orbital flight of Sputnik-2. All animals were recovered in good condition. The test animals were sacrificed at intervals ranging from two to sixty days after the flight. Samples of peripheral blood, spleen, and bone marrow were studied cytologically and histologically. The peripheral blood did not show any deviations from normal. The bone marrow showed an increase in myeloblasts, promyelocytes, myelocytes, and juvenile eosinophils; erythropoiesis was depressed. The spleen exhibited a depression of lympho- and myelopoiesis, with complete recovery by the thirtieth day.

841
Arsen'eva, M. A.,
V. V. Antipov, V. G. Petrukhin, T. S. L'vova, N. N. Orlova, S. S. Il'ina, L. A. Kabanova, and E. S. Kaliaeva
[CYTOLOGICAL AND HISTOLOGICAL CHANGES IN THE HEMATOPOIETIC ORGANS OF MICE UNDER THE INFLUENCE OF SPACE FLIGHT ON SPACESHIPS] Tsitologicheskie i gistologicheskie izmeneniia v krovotvornykh organakh myshei pod vliianiem kosmicheskogo poleta na korabliakh-sputnikakh.—Problemy kosmicheskoi biologii (Moskva), 2: 116-127. 1962. In Russian, with English summary (p. 127).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 104-122. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The results of experimental investigations conducted in space vehicles lead to the conclusion that space flight induces alterations of the bone marrow and spleen of mice which can be recorded two days after the flight and persist for a month afterwards. Clumping together of chromosomes occurred due to the combined effects of vibration and weightlessness. Experiments with acceleration and weightlessness suggest that these factors are likely to disturb the spindle apparatus of the cell during mitosis. The complex effects of space flight on the cell can be evaluated only after analysis of the components, their sequence, summation, and their effects on cell division. Further studies should clarify the biological effects of cosmic radiation as well as other dynamic flight factors and protective measures to be taken.

842
Balakhovskii, I. S.,
O. G. Gazenko, A. A. Giurdzhian, A. M. Genin, A. R. Kotovskaia, A. D. Seriapin, and V. I. Iazdovskii.
[RESULTS OF SPUTNIK EXPERIMENTS] Resul'tary issledovanii na sputnike.—Problemy kosmicheskoi biologii (Moskva), 1: 359-370. 1962. In Russian, with English summary (p. 370).

The dog "Laika" reacted satisfactorily to a transition from high acceleration to a state of weightlessness in the Sputnik-2 flight. During the active phase of the flight, the animal showed the physiological reactions normally associated with exposure to acceleration, vibration, and noise, similar to those observed in preceding laboratory experiments. During the orbital phase, the functional indices of the cardiovascular and respiratory systems returned to normal. No noticeable motor disturbances resulted, and no adverse reactions were detected due to weightlessness. (25 references)

843
Ballantyne, R. L.
SOME BASIC CONSIDERATIONS IN AVIATION AND SPACE BIOLOGY.—Amer. Biol. Teacher, 25 (5): 329-331. May 1963.

An outline is presented of the general problems encountered in aerospace physiology. Included are the effects on the pilot/astronaut of g-forces (angular, transverse, and radial accelerations), the maintenance of a proper physiological balance in respiration and circulation, and the effects of pressure changes at high altitudes (i.e., air embolism, aerotitis media, expansion of body gases).

844
Ballantyne, R. L.
CLASSROOM DEMONSTRATIONS IN AEROSPACE PHYSIOLOGY.—Amer. Biol. Teacher, 25 (5): 331-335. May 1963.

Detailed instructions are given for seven simple laboratory demonstrations in space biology showing the effects of altitude and acceleration. Various models are illustrated and materials and methods described for the following experiments: effects of pressure changes on body gases due to gases contained in the internal organs, effects of high altitude on body fluids and the auditory organ, cause of air embolism and "bends", and blood pooling and vertigo due to accelerations.

845
Balke, B.
HUMAN TOLERANCES.—In: Physiology of man in space, p. 149-171. Ed. by J. H. U. Brown. New York and London: Academic Press, 1963.

Human tolerances to psychophysiological stress, gravitational forces, hyperventilation, high altitude pressure variations, decompression sickness, hypercapnia, temperature extremes, and physical work are reviewed from the standpoint of an "average" individual and/or of an individual who has utilized all potential training and conditioning facilities for achieving the individually maximum level of adaptive capacity for the stresses anticipated. Most of the background of this chapter is based on research data gained by the author.

846
Belen'kii, M. L.,
A. F. Bliuger, and IA. IA. Shuster
[CHANGES IN THE ACTIVITY OF SOME BLOOD SERUM ENZYMES DURING EXPOSURE OF THE ORGANISM TO STRONG STIMULI] Izmeneniia aktivnosti nekotorykh fermentov syvorotki krovi pri vozdeistvii na organizm sil'nykh razdrahitelei.—Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 55 (5); 67-69. May 1963. In Russian, with English summary (p. 69).

Rats were exposed to various stresses which included hypoxia, asphyxia, and hypothermia. After exposure to an altitude equivalent to 4000 m. for a 2-hour period there was an increase in the activity of glutamine-pyruvic and glutamine-oxalacetic transaminases in the blood; no changes in activity of glutamine-pyruvic transaminase were noted after exposure to 6000 m.; however, the activity of glutamine-oxalacetic transaminase and aldolase was elevated. Asphyxia produced a drop in the concentration of both transaminases in the blood, accompanied by a rise in aldolase concentration. No changes in the enzyme concentrations were noted in rats after a 10-15 minute water immersion at 1° C., while a 20-90 minute immersion at 12-15° C. caused an increased activity of all three enzymes.

847
Bennett, G.
THE BIOLOGY OF THE ASTRONAUT.—Proceedings of the Royal Institution of Great Britain (London), 39 (2): 232-239. 1962.

The major biological stresses of space flight requiring special adaptation or protection of the astronaut include the severe forces consequent to rocket acceleration, the decreases in atmospheric pressure, the profound effects of weightlessness on normal physiological reactions, and the psychological effects of isolation and reduced body sensations. Consideration is also given to the hazards posed by meteorites, and solar and cosmic radiations.

848
Blatteis, C. M.
HYPOXIA AND THE METABOLIC RESPONSE TO COLD IN NEW-BORN RABBITS [Abstract].—Jour. Physiol. (London), 167 (1): 23P. June 1963.

In rabbits 2-12 days old exposure to cold (25° C.) caused a two- to threefold increase in oxygen consumption. This was at once greatly reduced by hypoxia (10% oxygen in nitrogen), but during the next four hours the rate of oxygen consumption increased again almost to the original level in the cold; this increase was usually accompanied by the development of vigorous shivering. Previous exposure to hypoxia in a neutral thermal environment for four hours did not modify the immediate reduction of oxygen consumption by hypoxia on subsequent exposure to cold. Exposure to cold for four hours (in air) also did not prevent the immediate effect of hypoxia, unless shivering had developed. In new-born rabbits exposed to cold, section of the carotid sinus and/or vagus nerves did not abolish the immediate fall in oxygen consumption caused by hypoxia. Therefore the fall cannot be attributed to chemoreceptor stimulation. (Author's abstract, modified)

849
Bourne, G. H.
NEUROMUSCULAR ASPECTS OF SPACE TRAVEL.—In: Physiology of man in space, p. 1-59 Ed. by J. H. U. Brown. New York and London: Academic Press, 1963

The fundamental anatomic and microscopic structures of somatic muscles as antigravity muscles are reviewed, with corresponding research data on motor innervation and their synergistic and antagonistic method of action. The effects of high g forces or subgravity on cardiac and smooth muscles are also mentioned. For space flight, the muscular system, in common with other systems, is subjected to three stresses: weightlessness, high g on take-off and landing, and radiation. Physiological and psychomotor research data on weightless states obtained by parabolic flights and water immersion are discussed. The function of muscles in compensating for acceleration stress is emphasized. The present state of knowledge of the effects of galactic cosmic radiation, solar cosmic radiation, and planetary radiation belts on the muscular system is reviewed. Many diagrams and photographs taken during experiments are reproduced. Also included are sketches of the space bottle suits designed by Dr. Wernher von Braun for the construction of a space station. (28 references)

850
Braun, J. R.,
and S. B. Sells
MILITARY SMALL GROUP PERFORMANCE UNDER ISOLATION AND STRESS: CRITICAL REVIEW. III. ENVIRONMENTAL STRESS AND BEHAVIOR ECOLOGY. — Texas Christian Univ., Fort Worth (Contract AF 41(657)-323); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8243-11). Technical Documentary Report no. AAL-TDR-62-33, June 1962. iv+23 p.

A critical research review is presented of behavioral effects of isolation, cold, and general stress, with particular reference to Aircraft Control and Warning (AC and W) sites in Alaska. On the basis of the literature, environmental stress does not appear as a major threat to adjustment of troops stationed at AC and W sites. Human engineering has contributed greatly to the comfortization and control of the environment, and there appears to be a wide difference between conditions of the area and conditions of the specific work and living environment, except in cases of emergency. The possibility of such emergencies may be a threat, but few have occurred. The positive values of motivation, training, and group dynamics (including leadership) as factors which offset the disorganizing effects of environmental stress are pointed out. (Authors' abstract) (50 references)

851
Broadbent, D. E.
DIFFERENCES AND INTERACTIONS BETWEEN STRESSES.— Quart. Jour. Exper. Psychol. (Cambridge), 15 (3): 205-211. Aug. 1963.

This paper reviews a number of experiments in which different stresses have been applied to comparable subjects performing similar tasks. It is argued that, since the effects of the stresses are different, it is not legitimate to think of a single mechanism mediating reaction to stress. Experiments on the simultaneous application of two stresses show that the effects of heat appear to be independent of those of noise and sleeplessness, while the latter two conditions partially cancel each other. It is therefore argued that noise and sleeplessness affect the same mechanism in opposite directions, while heat affects some other mechanism. Tentatively, noise is regarded as over-arousing and lack of sleep as under-arousing. (Author's summary)

852
Bugard, P.
[VARIATIONS OF 17-KETOSTEROIDS, 17-HYDROXYCORTICOSTEROIDS, AND URINARY CREATININE WITH RESPECT TO FLIGHTS ON INTERCONTINENTAL AIRPLANES] Variations des 17 cétostéroïdes, des 17 hydroxy-corticostéroïdes et de la créatinine urinaires en rapport avec vol sur avions intercontinentaux.—Revue de médecine aéronautique (Paris), 2 (5): 19-21. Nov.-Dec. 1962. In French.

A comparative study was made of urinary ketosteroid and creatinine elimination by 136 persons, all personnel of either jet Boeing-707 or conventional DC-6 for DC-7 airplanes. No differences in elimination were noted in women, but, in men, jet flying decreased 17-ketosteroid elimination by 8.9 mg. per 24 hours, and conventional airplane flying by 7.4 mg. per 24 hours. Increased 17-hydroxycorticosteroid elimination occurred in men during jet flight (4.97 mg. per 24 hours) and conventional airplanes (4.88 mg. per 24 hours) compared to controls (3.97±0.7 mg. per 24 hours). Two groupings of pilots were made: the first group with increased elimination of 17-hydroxycorticosteroids and creatinine, and the second group with decreased 17-hydroxycorticosteroid elimination but increased creatinine output. Such changes are probably due to emotional stress.

853
Calvet, H.
[OPHTHALMOLOGICAL INVESTIGATION: VARIATION OF HETEROPHORIAS DURING FLIGHTS ON FOUR-ENGINE JET AND CONVENTIONAL AIRCRAFT] Investigation ophthalmologique: variation des hétérophories lors des vols sur quadrireacteurs et avions conventionnels. — Revue de médecine aéronautique (Paris), 1 (4): 50-51. July-Aug. 1962. In French.

Heterophorias (exophoria, esophoria) and convergence-divergence curves were measured in persons flying conventional airplanes and four-engine jet aircraft, at the time of departure, during relief, and during landing. Comparative tabulations of the persons examined revealed on conventional aircraft little variation in the tests of oculomotor equilibrium, a slight change upon arrival and during rest, and return to normal conditions following rest. In four-engine jet aircraft personnel there was a constant aggravation of ocular tests, progressing after relief as if the body had no time for recuperation. It was confirmed that certain jet crews during departure were still fatigued from the preceding flight. These ophthalmological tests, together with a clinical, biological, and physiological test battery, may be of great value in confirming physical and psychological deterioration.

854
Chambers, R. M.,
R. Kerr, W. S. Augerson, and D. A. Morway
EFFECTS OF POSITIVE PRESSURE BREATHING ON PERFORMANCE DURING ACCELERATION. — Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Task no. MR005.13-1004.1, Report no. 7). Report no. NADC-MA-6205, July 2, 1962. v+32 p.

Two experiments were performed to assess the effects of positive pressure breathing on (1) the ability of subjects to perform a complex psychomotor task during exposure to high sustained transverse accelerations and (2) the ability of subjects to perform a visual brightness discrimination task during exposure to both transverse and positive accelerations. The results appear to suggest that positive-pressure breathing of 100% oxygen extends the perceptual and motor performance capabilities of man under conditions of prolonged high transverse acceleration. Many of the physiological symptoms (comfort, endurance, ease of breathing) of high transverse accelerations noted by previous investigators appear to have been somewhat alleviated by positive pressure breathing. The preliminary findings on the effects of positive pressure breathing on psychomotor performance and visual brightness thresholds are in general agreement with theoretical predictions.

855
Chang, P. K.,
D. S. Lee, and Y. S. Kwak
THE INFLUENCES OF THE FLYING STRESS TO THE URINARY 17-KETOSTEROIDS.—Republic Korea Air Force, Jour. Aviation Med. (Seoul), 10 (1): 45-49. June 1962. In Korean, with English abstract (p. 49).

The urinary 17-ketosteroid excretion of 31 pilots over a 24-hour period (including both flying and non-flying periods) was determined. During the rest period, 17-ketosteroid excretion was 13.3 ± 0.4 mg./day and during flying time it was 15.7 ± 0.4 mg./day. The urinary excretion during flying time was increased by 18.04%, with a statistical significance $P < 0.05$. (Authors' abstract, modified)

856
[FIVE QUESTIONS PERTAINING TO MAN IN SPACE] Cinq questions à propos de l'homme dans l'espace.—Homme et l'espace (Lausanne), no. 15: 29-35. March 1963. In French.

A discussion is presented by a panel of men in the field of space science (O. G. Gazenko, U. N. Tchernigovski, V. I. Yazdovski, E. P. Hiatt, Stanley C. White, and N. P. Sergeiev). Considered are the physical conditions of space flight affecting man, the problem of accelerations in the space vehicle and means of protecting the astronaut from them, future changes in the space program decreed by previous space flights, creation and maintenance of an artificial environment in the space capsule, and elimination of human waste products during space flight.

857
Colehour, J. K.,
and A. Graybiel
EXCRETION OF 17-HYDROXYCORTICOSTEROIDS, CATECHOL AMINES, AND UROPEPSIN IN THE URINE OF NORMAL PERSONS AND DEAF SUBJECTS WITH BILATERAL VESTIBULAR DEFECTS FOLLOWING ACROBATIC FLIGHT STRESS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-0004, Subtask 2); and National Aeronautics and Space Administration, Washington, D. C. (Order no. R-47). Report no. 1, May 10, 1963. ii + 11 p.

Six men with labyrinthine defects and eleven normal subjects were exposed to flight stress in an AD5 aircraft in an effort to determine the role of the vestibular organs in the excretion of catechols and steroids. Chemical measurements revealed that a significant increase in excretion of these stress hormones occurred in response to flight stress in case of the normal but not of the labyrinthine defective subjects which must have been attributable to the presence and absence, respectively, of the sensory organs of the inner ear. No significant changes in release of uropepsin were observed for either group. It is concluded that the vestibular organs must be taken into account in evaluating the effects of actual and simulated flight stresses where the gravitational inertial force environment is a variable. (Authors' abstract) (27 references)

858
Corcoran, D. W. J.
NOISE AND LOSS OF SLEEP. — Quart. Jour. Exper. Psychol. (Cambridge), 14 (3): 178-182. Aug. 1962.

Two experiments are reported in which human performance was compared under continuous 90 decibel white noise, after loss of sleep, under a combination of the two, and under appropriate control conditions. The results suggest that noise is effective in reducing the deterioration in performance, characteristic of loss of sleep. The relevance of the result to the arousal theory of loss of sleep is discussed. (Author's summary)

859
Dearnaley, E. J.
ESTIMATES OF ENDURANCE UNDER RISKY CONDITIONS.—Jour. Gen. Psychol., 68 (2): 243-250. April 1963.

Eighteen male subjects each made three attempts, separated by five-minute intervals, to maintain a tension of 10 kg. on a double-handled isometric myograph for as long as they could. Each subject made three estimates before his second and third attempts: (a) how long he thought he could maintain the stipulated tension; (b) the longest time for which he was sure he could maintain the tension; and (c) the shortest time for which he was sure he could not maintain the tension. Before either his second or third attempt the subject was told before his estimates that if he did not pull at the stipulated tension for as long as he estimated, he would receive an electric shock. The mean times for which the subjects maintained the tension did not vary significantly with the order of the attempt or whether or not they were under risk. When there was no risk during the second attempt but it was introduced for the third attempt the mean estimates were significantly reduced. When the risk was present for the second attempt but removed for the third attempt the mean estimates were not significantly changed. The estimates expressed as a percentage of the previous performance were significantly less when the threat was introduced but did not differ significantly when the threat was removed. In general the introduction of the threat of danger if an estimated endurance was not achieved brought about a reappraisal of the situation as a whole and led to smaller estimates of endurance. This reassessment persisted insofar as the removal of the risk did not lead to a corresponding increase in the estimated endurance. (Author's summary, modified)

860
DeNike, J.
THE SPACE ENVIRONMENT AND MAN.—Maryland State Med. Jour. 12 (6): 226-239. June 1963.

Utilization of manned flight rather than instrumentation only in space exploration is justified on the basis of the versatility of man in a system, i.e. he contributes to the flexibility, reliability, and maintenance of the system. The general problems of manned spaceflight explored in simulated environments are provision of suitable atmosphere, an acceptable food-waste cycle, and the biomechanical protection for launch and re-entry. Three problems that cannot be simulated are radiation, weightlessness, and psychological well-being. Theoretical estimates of the total radiation dose received by the crew on a projected short space flight show it to be within acceptable limits of tolerance. Weightlessness is not expected to be a problem for short flights because the vestibular system is capable of adjustment and other untoward physiological effects will be minimal. On longer space flights weightlessness may affect the myocardium, produce a negative nitrogen balance, and effect a demineralization of the skeletal system. In-flight exercise and/or artificial gravity may be used to offset these effects. Selection of trained experienced test pilots as astronauts is expected to eliminate psychological problems.

861
Dubinin, N. P.,
and O. L. Kanavets
[EFFECT OF COSMIC FLIGHT ON PRIMARY CHROMOSOMAL NON-DISJUNCTION] Faktory kosmicheskogo poleta i pervichnoe neraskhozhdenie khromozom.—Problemy kosmicheskoi biologii (Moskva), 1: 252-257. 1962. In Russian, with English summary (p. 257).

Unfertilized Drosophila females, homozygous for "white" genes (white eyes) were placed in Vostok-1. After their return, they were crossed with red-eyed males. It was established that the flies tested showed an increase of primary non-disjunction of X-chromosomes. This effect is of a prolonged type, different from previously known effects of X-ray irradiation. It is assumed that weightlessness, vibration, and other factors pertinent to orbital flight were responsible for the primary non-disjunction.

862
DuBois, A. B.,
R. W. Hyde, and E. Hendler
PULMONARY MECHANICS AND DIFFUSING CAPACITY FOLLOWING SIMULATED SPACE FLIGHT OF 2 WEEKS DURATION.—Jour. Applied Physiol., 18 (4): 696-698. July 1963.

Studies of pulmonary mechanics and diffusing capacity were carried out shortly after completion of exposure to the gas composition, barometric pressure, and acceleration profile simulating an earth orbital mission of two weeks duration. The values obtained for pulmonary function on the three subjects were normal. However, there still is a potential fire hazard in the atmosphere of 100% oxygen at 1/3 atmosphere. (Authors' abstract)

863
Dykman, R. A.,
P. T. Ackerman, C. R. Galbrecht, and W. G. Reese
PHYSIOLOGICAL REACTIVITY TO DIFFERENT STRESSORS AND METHODS OF EVALUATION. — Psychosomatic Med., 25 (1): 37-59. Jan.-Feb. 1963.

Several variables shown in past studies to be important determiners of autonomic activation in humans are re-examined in two test situations spaced one year apart. There is considerable individual variation in responsivity not explicable in terms of the variables studied. However, nearly all subjects exhibited in at least one autonomic system levels of reactivity paralleling the presumed stress effects of different conditions of stimulation. Subjective and objective measures of personality and emotionality appear to be less important determiners of physiological levels than the intensity of stress. A new method of scaling autonomic responses is outlined. (Authors' abstract)

864
Ekberg, D. R.
THE MICROCLIMATE OF SPACE VEHICLES (AN INTRODUCTION TO SPACE MEDICINE).—In: S[olco] W[alle] Troup, Medical biometeorology: weather, climate and the living organism, p. 717-731. Amsterdam: Elsevier Publishing Company, 1963.

Aspects of the control of microclimates in manned spacecraft are outlined. Section 1 summarizes the major environmental parameters which are altered in the movement from Earth into space (pressure, temperature, radiation, and gravity). Section 2 reviews the physiological requirements of man for a comfortable existence (partial pressures of oxygen, carbon dioxide, nitrogen, water vapor; total atmospheric pressure; temperature; radiation; gravity, or more precisely the lack of it as it affects orientation, motor coordination, and shifts in ion metabolism; and metabolism). Section 3 comprises three basic types of life support systems with emphasis on the closed type of system utilizing an external source of energy, either of the (1) natural or photosynthetic type which attempts to duplicate Earth environment, or (2) artificial or physical systems. Protection from ionizing radiation may be achieved by (a) shielding, (b) shadow shielding, (c) magnetic screening, and (d) a "space sweeper". Other problems involve decompression of the space vehicle and the creation of artifical gravity. Section 4 considers adaptation to a space vehicle environment—primarily the modification of biological rhythms in the absence of normal stimuli, e.g., light-dark alternation and magnetic field. (54 references)

865
Farrer, D. N.,
and V. Bogo
CHIMPANZEE PERFORMANCE DURING A SIMULATED THREE-DAY SPACE FLIGHT. — Aeromedical Research Lab. (6571st), Hollman Air Force Base, New Mexico (Project no. 6893, Task no. 689302). Technical Documentary Report no. ARL-TDR-62-25, Dec. 1962. vii+27 p.

Chimpanzee performance during a simulated 97-hour space flight profile environment was evaluated with a pilot study (two subjects) and a crossover design (two subjects). The response rate on a continuous avoidance task was significantly lower for one subject in a 100% O_2 environment, and both subjects performed at lower rates during night work sessions on all tests. There was no evidence of reaction time decrement for any subject on the discrete avoidance task. Food and water consumption was poor during the simulated space flight, but a chimpanzee could withstand a 97-hour flight profile environment of 100% O_2 at 14.7 p.s.i. for 15 hours followed by 100% O_2 at 5 p.s.i. for 82 hours without serious performance changes. (Authors' abstract)

866
Floru, R.,
R. Elias, E. Bittman, Margareta Sterescu-Volanschi, and A. Pescaru
[STUDIES ON THE CHANGES OF HIGHER NERVOUS ACTIVITY AND OF THE CEREBRAL BIOELECTRICAL POTENTIAL IN WORKERS IN A MECHANIZED AND AUTOMATIC INDUSTRY] Cercetări privind modificările activităţii nervoase superioare şi potentialelor bioelectrice cerebrale la muncitori in producţia mecanizată şi automatizată.—Studii şi

cercetari de fiziologie (Bucureşti), 7 (4): 601-610. 1962. In Rumanian, with French summary (p. 609-610).

Spontaneous electroencephalographic changes in persons working in a mechanized and automated industry were studied as affected by continuous or intermittent light stimulation, intermittent auditory stimulation, proprioceptive stimuli, and psychological activity (mental calculation). At the end of the work day the alpha index was elevated in most workers. The alpha rhythm arrest reaction after extero- and proprioceptive stimuli decreased until it disappeared. Weakening of activator effort was more evident for visual stimuli. The latency period for motor conditioned reflexes increased and intensity of the reactions decreased. As a result of nervous effort during work, a phase of equalization of motor reactions to different intensity stimuli appeared and decreased the motility of the nervous processes.

867
Giurdzhian, A. A.,
N. N. Demin, N. V. Korneeva, T. S. L'vova,
L. T. Tutochkina, M. S. Uspenskaia, and T. A. Fedorova
SOME ASPECTS OF THE METABOLISM OF ANIMALS AFTER A SPACE FLIGHT.—Artificial Earth Satellites (Consultants Bureau, New York), 11: 82-90. Sept. 1962.

English translation of: Nekotorye storony metabolizma u zhivotnykh sovershivshikh polet v kosmos.—Iskusstvennye sputniki zemle (Moskva), 11: 78-86. 1961. In Russian.

Shifts in biochemical indices (protein fractions and the total protein content of blood serum, serum mucoid content, nonspecific cholinesterase activity, free and bound 21-hydroxy-20-ketosteroids in the urine, presence of deoxycytidine in the urine) were investigated in a number of dogs, rats, and mice after single or repeated exposures to vibration, accelerations of 6-9 g, and a prolonged stay in a sealed cabin. For some of the animals data from space and rocket flights were available. Single exposures to different stresses resulted in shifts indicative of compensatory reactions, while repeated exposures were followed by a dystrophic state. The dogs Belka and Strelka exhibited a reversible stress reaction after space flight which differed considerably from the picture observed after radiation injury. The extent of biochemical changes seems to be more dependent upon the dose of stress rather than its nature.

868
Giurdzhian, A. A.,
N. N. Demin, L. T. Tutochkina, M. S. Uspenskaia, and T. A. Fedorova
[BIOCHEMICAL STUDIES OF BLOOD AND URINE OF ANIMALS AFTER SPACE FLIGHTS] Biokhemicheskie issledovaniia krovi i mochi zhivotnykh, sovershivshikh polet v kosmicheskikh korabliakh. — Problemy kosmicheskoi biologii (Moskva), 1: 152-160. 1962. In Russian, with English summary (p. 160).

The test animals were dogs and mice which had been enclosed in Sputnik 2, 4, and 5. The serum proteins showed a considerable fluctuation when compared with control groups. The relative concentrations of α_1 and α_2 globulins were higher, while the relative concentrations of albumins and total proteins were lower than in the controls. Most significant was the increase in serum mucoids. The changes noted are characteristic of "dystrophy". It is concluded that a single space trip did not result in irreversible metabolic changes. The changes observed were due to stress and not to radiation injury.

869
Glembotskii, IA. L.,
A. A. Prokof'eva-Belgovskaia, Z. B. Shamina,
V. V. Khvostova, S. A. Valeva, N. S. Eiges, and
L. V. Nevzgodina
[EFFECT OF SPACE FLIGHT ON HEREDITY AND DEVELOPMENT OF ACTINOMYCETES AND HIGHER PLANTS] Vliianie faktorov kosmicheskogo poleta na nasledstvennost' i razvitie u aktinomitsetov i vysshikh rastenii.—Problemy kosmicheskoi biologii (Moskva), 1: 236-247. 1962. In Russian, with English summary (p. 247).

Four actinomycetes strains, seeds of two varieties of pea, two varieties of corn, and a variety of winter wheat were exposed to orbital flights in Sputniks 4 and 5. Actionomyces erythreus, strains 8594 and 2577, A. streptomycini Kras, strain LS-3, and A. aureofaciens, strain LS-B-2201, proved sensitive to orbital flights. The number of spores that survived and developed colonies of radiation-resistant A. erythreus 2577 strains increased 6 times after the flight, while the viability of the radiation-sensitive strain 8594 decreased 12 times and that of A. aureofaciens 2201 by 75% as compared to controls. The mycelial growth rate was higher during immersed fermentation of surviving spores of A. erythreus, (strains 8594 and 2577) and of A. streptomycini Kras. The seedlings of peas, corn, and winter wheat showed an increase in chromosomal rearrangements. However, statistical validity was established only in the case of winter wheat and peas of the "Spartanets" variety. A statistically valid increase in mitotic rate was noted in "Spartanets" peas and "Podmoskovnaia" corn.

870
Glembotskii, IA. L.,
and G. P. Parfenov
[THE EFFECT OF SPACE FLIGHT FACTORS ON SOME BIOLOGICAL INDICES IN INSECTS] Vliianie faktorov kosmicheskogo poleta na nekotorye biologicheskie pokazateli u nasekomykh.—Problemy kosmicheskoi biologii (Moskva), 2: 98-115. 1962. In Russian, with English summary (p. 114-5).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 104-122. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The five flights of the Russian satellites II, LV, V, "Vostok", and "Vostok-2" were used for testing the mutagenic effect of cosmic flight conditions on Drosophila melanogaster. The findings indicate a broad spectrum of mutations induced by space flight. Hereditary changes were obtained, which were associated with non-disjunction of chromosomes at meiosis, chromosomal rearrangements (dominant lethals and crossing-over in males), and point-mutations (recessive lethals). The wide spectrum of mutations resulting from cosmic flights of relatively short duration which did not reach the zones of high radioactivity calls for an investigation of the mutagenic factors of space flight separately and with respect to their interaction. Experiments on the vibration chair indicate that chromosome rearrangement may be induced by the rocket vibration, but not the point-mutations.

871
Glembotskii, IA. L.,
G. P. Parfenov, and IU. A. Lapkin
[THE EFFECT OF SPACE FLIGHT ON THE FREQUENCY OF APPEARANCE OF RECESSIVE SEX-LINKED LETHAL MUTATIONS IN DROSOPHILA MELANOGASTER] Vliianie faktorov kosmicheskogo poleta na chastotu vozniknoveniia stseplennykh s polom retsessivnykh letal'nykh mutatsii u Drosophila melanogaster.—Izkusstvennye sputniki zemli (Moskva), 15: 113-119. 1963. In Russian.

Two lines of Drosophila melanogaster, D-18 and D-32, showed an increase in sex-linked recessive lethal mutations after exposure to orbital space flight (in Sputniks 4 and 5 and Vostok 1 and 2). The increase was especially pronounced after the flight of Vostok 2, while after the other flights the incidence of mutations was not statistically significant. Laboratory experiments failed to confirm the exclusive significance of vibration as a mutagenic factor. It is therefore concluded that a selective testing should be undertaken to study independently the factors of space flight and their relations to heredity.

872
Grandpierre, R.,
and R. Angiboust
[PHYSIOLOGICAL RESULTS OF THE FIRST FRENCH BIOLOGICAL EXPERIMENT WITH ROCKETS] Résultats physiologiques de la première expérience biologique française en fusée. — Onde électrique (Paris), 42 (418): 21-22. Jan. 1962. In French.

Rats exposed to accelerations of +9.5 through -4.5 g in a Veronique rocket for a quarter of an hour exhibited a decrease in respiratory and cardiac rhythm. No significant effects of weightlessness were observed. Cerebral action potentials revealed an intense cortical activation during the flight. In contrast, the rhythm of the mesencephalic reticular substance remained static for the first 100 seconds of the flight, then progressively decreased. Also observed were intense muscular contractions of the neck.

873
Green, I. D.,
and B. F. Burgess
AN INVESTIGATION INTO THE MAJOR FACTORS CONTRIBUTING TO POST FLIGHT CHEST PAIN IN FIGHTER PILOTS. — Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC/

A field trial is described which investigated the part played by each of three factors (level of applied acceleration, breathing of 100% oxygen, wearing an anti-g suit) in the production of a post-flight syndrome (characterized by cough, chest pain, limitation of inspiration) experienced by fighter pilots. Chest X-rays were taken and lung volume measurements made of six pilots before and after flight in Hunter Mark 6 aircraft. The results of the test and symptoms experienced by these pilots led to the conclusion that all three factors under investigation contributed to the syndrome. The possible pathological changes that may have taken place during the flights are discussed together with the likelihood of any ill effects such changes might produce. (Authors' summary, modified) (20 references)

874
Gurjian, A. A.
BIOLOGICAL EFFECTS OF COSMO RADIATION ON SPACE SHIPS-SATELLITES.—Revue de médecine aéronautique (Paris), 1 (3): 15-16. March-April 1962. In English.

A review is presented of Soviet experiments dealing with cosmic radiation carried out on board space ships containing biological specimens. The experiments utilized mammals (dogs, rats, mice, guinea pigs), Drosophila flies, vegetable specimens, Chlorella algae cultures, and various microbiological and cytobiological specimens at tissue, cellular, subcellular, and molecular levels (human and rabbit skin, tissue cultures of He-La cells, fibroblasts, human amnion cells, bacteria, phages, desoxyribonucleic acid). The experiments did not reveal any considerable influence of the flight conditions upon the microbiological and cytobiological specimens. Studies were made on the effects of cosmic rays on natural immunity, hemodynamics, genetics, etc., of the specimens. Additional study is required.

875
Hall, C. E.
STRESS.—In: Physiology of man in space, p. 113-148. Ed. by J. H. U. Brown. New York and London: Academic Press, 1963.

Systemic stressors in orbital and space flight include acceleration, weightlessness, thermal extremes, collision with meteorites, cabin pressure variations, nutritional requirements, isolation and sensory deprivation, and ionizing radiation. Each stressor is discussed separately, and data on these pathological effects of stress are reviewed: mental disturbances, cardiovascular and gastrointestinal disorders, and infectious diseases and inflammation. In order to understand better the participation of stress in human disease, a method of quantifying stress other than by the biological effects caused should be found, the term "space stress" should be recognized, if only to encourage more thorough investigation. (130 references)

876
Hughes, E. C.
LIFE IN INNER SPACE.—Amer. Jour. Nursing, 63 (1): 92-94. Jan. 1963.

A simile is presented of the fetus in utero, and the astronaut in the space capsule. One of the dangers for the astronaut is vibration of the capsule, therefore protective jackets were developed. Nature's jacket for the fetus is the fluid barrier, amniotic fluid, which protects it from the stress and strain of vibration. This may create a sensation of

weightlessness, which is a problem for men in outer space. Although similar conditions exist in both types of capsules, the major problem is to supply oxygen and food to the subjects living within the capsule. In the case of the astronaut, oxygen is supplied by a carefully adjusted mechanical device and is inhaled through a face mask which must be worn at all times. In the embryo or fetus it is supplied early in gestation by the process of osmosis, the oxygen coming from the uterine decidua, etc. The development of hypoxia is dangerous to both astronaut and fetus.

877
Iakovlev, V. V.
[RESULTS OF STUDIES OF SOME PERIPHERAL VASCULAR INDICES IN DOGS DURING AND AFTER SPACE FLIGHT] Resul'taty issledovaniia nekotorykh pokazatelei perifericheskikh sosudov u sobak vo vremia i posle poleto v kosmicheskoe prostranstvo. —— Problemy kosmicheskoi biologii (Moskva), 1: 166-170. 1962. In Russian.

Maximal arterial pressure, arterial tonus, venous pressure, venous tonus, and the rate of blood flow were studied with the aid of a plethysmographic universal manometer designed by the author (1958). No changes in maximal arterial pressure nor in venous pressure were noted in the dog, Belka, after the space flight. Only slight changes were observed in arterial and venous tonus and in the flow rate of blood. While the space flight was in progress, changes occurred in maximal arterial pressure, venous pressure, and arterial tonus. The results indicate that no significant changes occurred in the peripheral vascular system.

878
Jones, H. Gwynne
SHOULD COLONEL GLENN TRY AGAIN? —— New Scientist (London), 13 (273): 304-305. Feb. 1962.

Apart from the obvious dangers of space flight, astronaut John Glenn was subjected to intense psychological stress preparatory to the launching of the Mercury capsule into space, especially the anticlimax of postponement of the launching. The danger of emotional or physical disorder as a result of such a stress situation is considered to lower the astronaut's general efficiency and to increase the risk of mishap. The importance of training, personality, and the psychological effects of the total situation in task performance are considered. These tend to reduce the difficulty of the task, reduce the strength of the disruptive component of the astronaut's motivation, and increase its energizing component.

879
Jovy, D.,
H. Bruner, and K. E. Klein
ON THE UNSPECIFIC STIMULATION OF THE ORGANISM BY VARIOUS STRESSORS.—In: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 305, p. 94-108. Oct. 1963. In English and German.

Graphs are given to denote the interrelationships between cardio-circulatory, respiratory, and hypophyseo-adrenocortical systems during the stress of oxygen deficiency, muscular work, heat, cold, and acceleration. The systems responded markedly in the same persons under all stresses.

880
Kas'ian, I. I.,
E. M. IUuganov, and T. S. L'vova
[CHANGES OF SOME MORPHOLOGICAL AND BIOCHEMICAL INDICES IN THE PERIPHERAL BLOOD OF ANIMALS AFTER ROCKET FLIGHTS] Izmeneniia nekotorykh morfologicheskikh i biokhemicheskikh pokazatelei krovi zhivotnykh posle poleta na raketakh. —— Problemy kosmicheskoi biologii (Moskva), 1: 161-165. 1962. In Russian.

Observations were made on 12 dogs of both sexes after ballistic flight. The data obtained showed an increased leucocyte count, shortened coagulation time, and increased Ca and prothrombin levels in the blood.

881
Kas'ian, I. I.
[REACTIONS OF THE CARDIOVASCULAR AND RESPIRATORY SYSTEMS OF ANIMALS DURING FLIGHTS IN SEALED CAPSULES OF ROCKETS UP TO THE ALTITUDE OF 212 KM.] Reaktsii serdechno-sosudistoi i dykhatel'noi sistem zhivotnykh pri poletakh v germeticheskikh kabinakh raket do vysoty 212 km.—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1963 (1): 24-39. Jan.-Feb. 1963. In Russian, with English summary (p. 39).

During 1958-60, six dogs were repeatedly subjected to the stresses of high-altitude rocket flights. Immediately before the flight the systolic arterial pressure was, on the average, 170-180 mm. Hg, the diastolic pressure 40-90 mm. Hg, the pulse rate 90-205 c./min., and the respiration rate 12-257 c./min. During periods of acceleration the diastolic pressure rose by 20-80 mm. Hg, the systolic pressure increased by 20 mm. Hg, while the average pulse rate was increased by 25-175 c./min., and the respiration rate by 30-115 c./min. Reactions to weightlessness varied, while the re-entry phase was characterized by an increase in the pulse and respiration rates as compared to the state of weightlessness. The paper is illustrated with numerous diagrams of telemetric records. No pathological effects were noted in the animals 3.5 to 4 years after the flights.

882
Khvostova, V. V.,
A. A. Prokofe'eva-Bel'govskaia, B. N. Sidorov, and N. N. Sokolov
[THE EFFECT OF SPACE FLIGHT CONDITIONS ON THE SEEDS OF HIGHER PLANTS AND ACTINOMYCETES] Vliianie uslovii kosmicheskogo poleta na semena vysshikh rastenii i na aktinomitsety.—Problemy kosmicheskoi biologii (Moskva), 2: 153-163. 1962. In Russian, with English summary (p. 163).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 161-172. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

A slight genetic effect was detected on the seeds of some plants which were part of the biomaterial in the space ships II, IV, V, "Vostok", and "Vostok-2". It was manifested as an increase in the percentage of cells with chromosome aberrations in the first mitoses of the rootlets in wheat seeds after flights in the space ships II, "Vostok", and "Vostok-2", and in pea seeds after flights in space ships II and "Vostok-2". No genetic effect was seen in the seeds of Allium fistulosum, Nigella damascena, or spores of Actinomycetes. Physiological effects of space flight appeared as stimulation of the germinating ability and growth in seeds, and as an increase in the growth rate of the mycelium in some Actinomycetes. A varying sensitivity of plants to space flight conditions was also observed. Increased chromosome aberrations were the highest in polyploid plants (wheat). Viability of spores differed in different strains of Actinomycetes. At this stage it has not been differentiated as to which effects are attributable to the individual factors of vibration, acceleration, weightlessness, or cosmic radiation.

883
Klein, K. E.,
H. Bruner, and D. Jovy
INFLUENCE OF ACCLIMATIZATION TO HIGH ALTITUDE ON THE PHYSIOLOGICAL RESPONSE TO STRESS.—Indus. Med. and Surg., 32 (2): 79-80. Feb. 1963.

The physiological responses of three persons participating in an expedition to the Andean Mountains were examined prior to and a few weeks after their sojourn of four weeks at an altitude of 21,000 feet. A marked adaptation was found in the unspecific hypophyseo-adrenocortical system which improved the reaction of circulation, respiration, metabolism, and other physiological functions to different stress situations. The presence of corticosteroids enables the organism to produce the necessary protective reactions under stress. These results indicate that an increased resistance can be developed to the stressors that are of importance with regard to flying performance and survival in emergency situations.

884
Klemparskaia, N. N.
[THE EFFECT OF SPACE FLIGHT ON THE DISSOCIATION OF INTESTINAL BACTERIA] Vliianie uslovii kosmicheskogo poleta na dissotsiatsiiu kishechnykh bakterii.—Iskusstvennye sputniki zemli (Moskva), 15: 104-108. 1963. In Russian.

Live suspensions of intestinal bacilli K-12 were analyzed one month after exposure to space flight in Vostok-2. The colonies were of two types: the first type was round, large (3-4 mm.), and semitransparent, similar to control colonies. The second type, which was more numerous, was small (about 1 mm. in diameter) and transparent. The latter grew better on agar than in Endo's medium; the individual bacteria were small gram-negative rods of polymorphic appearance. They did not split glucose, lactose, or sucrose, did not produce indole or hydrogen sulfide, did not reduce neutral red, and did not assimilate sodium citrate. Laboratory exposure of control bacteria to vibration and radiations resulted in the formation of colonies of the second (small) type; however, these never were as numerous as the colonies grown from bacteria flown in Vostok-2. The cultures isolated from individual flight-exposed colonies were tested for agglutination with three different antisera. The atypical negative strains had a low agglutination capacity and probably had different antigenic properties, since their antisera did not react with typical cultures.

885
Konecci, E. B.
BIOASTRONAUTICS. — Astronautics, 7 (11): 104-109. Nov. 1962.

The National Aviation and Space Agency Biotechnology and Human Research Program is concerned with the human factors in all aspects of space flight. Human research considers man under normal and unusual conditions in order to determine the function of body systems under various environmental conditions, such as atmosphere, acceleration, radiation, and electrostatic, magnetic, and thermal conditions. Human psychophysiological and behavioral sciences are also studied. The data obtained therefrom lead to design criteria for life-support systems, personal equipment, protective systems, and man-machine control, which include information handling, display, and controls. A representation of the Life Sciences Program is given in a table, along with a review of several government- and company-funded life science programs. A review of U. S. and Soviet space-suit development reveals some similarities, but differences in objectives and design. Reviewed briefly are some physiological aspects of the Vostok III and IV flights.

886
Koviazin, N. V.,
A. A. Lukin, and G. P. Parfenov
[THE EFFECT OF COSMIC FLIGHT FACTORS OF "VOSTOK-2" UPON MICROORGANISMS: STUDIES ON YEASTS OF DIFFERENT PLOIDY] Vliianie faktorov kosmicheskogo poleta korablia-sputnika "Vostok-2" na mikroorganizmy: issledovanie na drozhzhevykh organizmakh raznoi ploidnosti. — Iskusstvennye sputniki zemli (Moskva), 13: 123-129. 1962. In Russian.

Cosmic flights on "Vostok-2" had no effect upon haploid or diploid yeast cells in an aqueous medium in hermetically sealed glass ampules. Oleic acid (slightly acidulated), if added to the medium in very low concentration, will increase the sensitivity to cosmic rays in haploid cells (50% died) without affecting the diploid cells. In higher concentrations it was less effective as evidenced by the greater number of surviving haploid cells.

887
Koviazin, N. V.,
A. A. Lukin, and G. P. Parfenov
[THE EFFECT OF SPACE FLIGHT FACTORS OF THE SATELLITE "VOSTOK-2" ON HAPLOID AND DIPLOID YEASTS] Vliianie faktorov kosmicheskogo poleta korablia-sputnika "Vostok-2" na gaploidnye i diploidnye drozhzhevye organizmy.—Problemy kosmicheskoi biologii (Moskva), 2: 149-152. 1962. In Russian, with English summary (p. 152).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 156-160. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Haploid and diploid yeast organisms placed in an aqueous medium, some sensitized with oleic acid, were exposed to the 25-hour cosmic flight of Vostok-2. The effect was assessed in terms of cell survival. The space flight affected neither the haploid nor the diploid yeast cells of the unsensitized cultures. In the cultures containing oleic acid, the survival of haploid cells was drastically decreased (by about 50% at low concentrations of the acid) while the diploid yeasts were not affected.

888
Kragh, U.
PREDICTIONS OF SUCCESS OF DANISH ATTACK DIVERS BY THE DEFENSE MECHANISM TEST (DMT). —— Perceptual and Motor Skills, 15 (1): 103-106. Aug. 1962.

Three small groups of Danish attack divers were tested with the Defense Mechanism Test (DMT), and the protocols coded, rated, and ranked independently by three raters. The DMT is a projective test involving tachistoscopic exposures to pictures of figures whom the testee can identify in stories or drawings. All the raters' predictions, based exclusively on the DMT, correlate positively and significantly with the criteria of officers' ratings of the subjects. It is suggested that the DMT is suited for predicting success of various types of personnel working under conditions of stress. (Author's summary, modified)

889
Kunzmann, H.
[QUANTITATIVE AND MORPHOLOGICAL CHANGES OF HUMAN BLOOD UNDER DIFFERENT CONDITIONS OF STRESS] Des changements quantitatifs et morphologiques du sang humain sous différentes conditions de stress.—Revue de médecine aéronautique (Paris), 1 (3): 25-26. March-April 1962. In French.

Also published in: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 88-93. Oct. 1963. In French and German.

Hematological studies were made in subjects exposed to intense work (30 minutes on ergometer), acute anoxia, and acceleration (centrifugal force of 4 g for 4 minutes). Increases were found in erythrocytes, hemoglobin concentration, hematocrit value, and leukocytes of subjects during intense work and anoxia. Also increased during intense work were lymphocytes, eosinophil granulocytes, and monocytes. Insignificant changes were seen in reticulocytes and neutrophil granulocytes. Neutrophilic leukocytes remained constant or decreased slightly. During anoxia there were increases also in eosinophil granulocytes, neutrophil granulocytes, reticulocytes, and leukocytes. During acceleration the erythrocytes remained constant and the leukocytes and lymphocytes increased. These results correspond to the characteristic change of the blood leukocyte formula following an increase of corticosteroids, which may be considered as compensatory hormonal adjustment.

890
Land, J. C.
THE HOSTILE AEROSPACE ENVIRONMENT: DANGERS TO MAN IN THE ENVIRONMENT OF FLIERS—PAST, PRESENT AND FUTURE. —— Med. Jour. Australia (Sidney), 1963 (12): 419-421. March 1963.

A review is presented of the physiological problems associated with aviation and space flight. These include: regulation of cabin temperature and pressure; maintenance of an adequate oxygen supply; prevention of high altitude hypoxia, decompression sickness, disorientation due to tumbling, and motion sickness; accelerations and their effects on the cardiovascular system; weightlessness; psychological stresses; and hazards from Van Allen and solar radiations. The human body has revealed considerable adaptability to these stresses, but, for the most part, engineered microenvironments are needed for survival and good performance in the aerospace environment.

891
Lavernhe, J.,
E. Lafontaine, and R. Laplaine
[SUPERSONIC AIR TRANSPORTATION: MEDICO-PHYSIOLOGICAL ASPECTS] Le transport aérien supersonique: aspects médico-physiologiques.—Presse médicale (Paris), 70 (35): 1689-1691. July 28 - Aug. 4, 1962. In French.

Two important factors affect man during supersonic flight: (1) those related to altitude, such as atmospheric depression which may result in expansion of body gases in lungs, gastrointestinal tract, ear, etc., anoxia, aeroembolism, and ebullism; and (2) those related to high speeds, including hazards from the heating of aircraft and equipment, noise and sonic boom, and time changes. The problems associated with ozone toxicity and ionizing radiations at high altitudes must be eliminated to make flight safe. Moreover, the visual problems affecting the aircrew (space myopia, illumination, and color problems), and the psychological problems of the aircrew (adaptation to instruments) and of the passengers (anxiety, claustrophobia, noise tension) are discussed. The anticipated flight altitude (15-25 km.) necessitates rigorous cabin pressurization and means of temperature regulation in order to protect occupants from fatal consequences.

892
Lawton, R. W.
THE PHYSIOLOGICAL EFFECTS OF UNUSUAL ENVIRONMENTS.—In: Unusual environments and human behavior, p. 3-31. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

The physiological mechanisms which operate to maintain homeostasis under environmental stresses are reviewed. Adaptive processes, particularly their time course and limitations, are discussed with reference to cardiovascular, thermal, visual, and respiratory stress conditions. The problem of detecting more generalized stress states, such as anxiety, are discussed, and the areas requiring further study, such as the presence or absence of magnetic fields and innate biological rhythms, are delineated. (34 references)

893
Lomonaco, T.,
and A. Scano
[PHYSIOPATHOLOGICAL EFFECTS OF SPACE FLIGHT AND BIOLOGICAL PROBLEMS OF ASTRONAUTICS] Gli effetti fisiopatologici del volo spaziale e i problemi biologici della cosmonautica.—Ulisse (Firenze): 7: 17-38. June 1962. In Italian.

In recent years science has achieved great advances which have made it possible for man to participate in orbital flight. For the near future a wider penetration into interplanetary space is anticipated. This will expose astronauts to new biological hazards which so far have been only incompletely studied. Among them are the effects of accelerations and prolonged exposure to weightlessness, effects of ionizing radiations, psychological effects brought about by the new and difficult environment, and the greater probability of accidents.

894
Lomonaco, T.
[THE EXTREME LIMITS OF PHYSIOLOGICAL TOLERANCE TO SOME CONDITIONS OF MODERN FLIGHT AND SPACE FLIGHT] Gli estremi limiti di tolleranza fisiologica in alcune condizioni del volo moderno e del volo spaziale.—Rivista di medicina aeronautica e spaziale (Roma), 26 (3): 383-403. July-Sept. 1963. In Italian, with English summary (p. 402).

The physiological limits of tolerance to various flight stresses are reviewed. The hypoxia tolerance limit of normal subjects breathing pure oxygen is reached at 90-108 mm. Hg barometric pressure, of acclimatized subjects at 77-87 mm. pressure; with pressure breathing (20-35 mm. above surrounding) the values are 77-87 mm. and 45-61 mm., respectively. Carbon dioxide tolerance in the air breathed is 7% for acute exposure and 3% for chronic exposure. The limit of altitude tolerance under conditions of explosive decompression is about 19,000 m. above sea level (or 47 mm. Hg barometric pressure), i.e., when the vapor pressure of the water at body temperature is reached. The temperature limits of the environment are determined by the effects on the body temperature. Tolerance to positive acceleration is about 10 g for 2 seconds, 8 g for 5 sec., and 5 g for 10 sec. Negative acceleration of 4 g is tolerated for 2 sec., 2-3 g for 5 sec., and 2 g for 10 sec. Transverse acceleration of 11-14 g may be withstood 120-180 sec. without irreversible injury. Impact tolerance of animals has been determined as 100-1,250 g for a small fraction of a second. Effects of prolonged weightlessness cannot be studied on Earth; American and Russian space flights indicate that weightlessness is well tolerated for the limited durations so far applied.

895
Lorentzen, F. V.
LACTIC ACID IN BLOOD AFTER VARIOUS COMBINATIONS OF EXERCISE AND HYPOXIA. —Jour. Applied Physiol., 17 (4): 661-664. July 1962.

Seventy-five tests were made on military personnel 20-25 years old. Exercise at a constant work load was done on a bicycle ergometer for 15 minutes at a chosen simulated altitude. The loads were from 400 to 1,200 kg.-m./minute and the simulated altitudes were from 10,000 to 17,000 feet. In these experiments on randomly chosen, enlisted Air Force soldiers there was a very great deviation in results, indicating that care must be taken in drawing conclusions about the conditions of stress and altitude from the amount of lactic acid present after an incident. (Author's abstract)

896
Lozina-Lozinskii, L. K.
[CYTOLOGICAL STUDIES AND SPACE BIOLOGY] Tsitologicheskie issledovaniia i kosmicheskaia biologiia.—Problemy kosmicheskoi biologii (Moskva), 2: 40-47. 1962. In Russian, with English summary (p. 46-7).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 44-50. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Cytological research on the possible existence of life on other planets is directed at exploring the limits of life in the active and latent states as well as the capacity of adaptation by cells and organisms to extreme environmental conditions at different levels of the animal and vegetable world. Aerobic microorganisms as well as spore-forming bacteria, yeasts, molds, and actinomycetes have developed normally under simulated Martian conditions. Oidial cells of fungi were shown to be most resistant to deep hypothermia in liquid oxygen. Tolerance of deep hypothermia by higher invertebrates is still an unsolved problem. Increased resistance to environmental stresses has been investigated *in vitro* and *in vivo* with various animal species with emphasis on the inhabitants of high mountain areas.

897
Luk'ianova, L. D.
[LONG-TERM OBSERVATIONS OF CONDITIONED REFLEX ACTIVITY IN WHITE RATS AFTER FLIGHT IN THE SECOND SPUTNIK] Nabludenia za uslovnoreflektornoi deiatel'nost'i belykh krys v otdalennie sroki posle poleta na vtorom kosmicheskom korable-sputnike.—Problemy kosmicheskoi biologii (Moskva), 1: 171-180. 1962. In Russian, with English summary (p. 180).

Two white male rats were used in the experiment, five were used as controls. The training of the test animals began six months prior to flight, by the motor-food method of Kotliarevskii. No significant changes were noted in the conditioned food reflexes of the test animals as compared to the controls.

898
Luk'ianova, L. D.,
N. N. Livshits, Z. I. Apanasenko, and M. A. Kuznetsova
[REMOTE EFFECT OF SPACE FLIGHTS ON HIGHER NERVOUS ACTIVITY AND SOME UNCONDITIONED REFLEXES] Otdalennoe deistvie kosmicheskikh poletov na vysshuiu nervnuiu deiatel'nost' i nekotorye bezuslovnye refleksy.—Problemy kosmicheskoi biologii (Moskva), 2: 192-205. 1962. In Russina, with English summary (p. 205).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 203-219. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21427)

Conditioned reflex activity of white rats which had been on board the Soviet Satellite II as well as their vestibular reflexes, spontaneous bioelectric activity of skeletal muscles, and unconditioned flexion-defense reflexes in the guinea pig on the Satellite IV were investigated at various intervals after the flights. The guinea pig exhibited a statistically significant increase of spontaneous bioelectrical activity in skeletal muscles and excitation of the vestibular apparatus. There were no significant changes in the latent period of the unconditioned motor defense reflexes in the guinea pig. Indices of the conditioned reflex activity of rats did not differ from the controls from the fourth day of recovery up to their natural death.

899
McCutcheon, E. P.,
C. A. Berry, G. F. Kelly, R. M. Rapp, and R. Hackworth
PHYSIOLOGICAL RESPONSES OF THE ASTRONAUT. — In: Results of the second United States manned orbital space flight, May 24, 1962, p. 54-62. Washington, D. C.: National Aeronautics and Space Administration, 1962.

All flight responses in the MA-7 mission of M. S. Carpenter, May 24, 1962, provided an appreciable extension to the observation of man's physiological responses to space flight (accelerations, weightlessness, artificial environment, etc.), and were considered to be within acceptable physiological ranges. Specifically, the heart-rate response to nominal exercise demonstrated a reactive cardiovascular system. An aberrant electrocardiographic (ECG) tracing recorded during reentry possibly resulted from increased respiratory effort associated with continued speech during maximum acceleration. No disturbing body sensations were reported as a result of weightless flight. Astronaut Carpenter felt that all body functions were normal. Solid food could be successfully consumed in flight, but precautions must be taken to prevent crumbling. The respiration rate sensor provided good prelaunch but minimal in-flight coverage. Because of erratic amplifier behavior, the rectal temperature thermistor gave incorrect values for approximately 1/3 of the flight. In-flight blood pressure could not be interpreted. Included are tabulated data from clinical examination, bioinstrumentation, and subjective in-flight observations. (Authors' summary, modified)

900
Mallick, D. L.,
and H. E. Ream
CREW PERFORMANCE AND PERSONAL OBSERVATIONS ON A LUNAR MISSION SIMULATION. — Institute of Aerospace Sciences, New York, N. Y. IAS Paper no. 63-18, 1963.

Three trained test pilots performed realistic duties during simulations of three missions. The areas evaluated included duty cycles, physical conditioning of crew members prior to and during the mission, crew proficiency in normal mission duties, and crew alertness to emergency situations. The study showed no difficulties with test-pilot personnel for confinement periods up to 7 days. It was found that a 26-hour duty cycle with two 4-hour sleeping periods was suitable for a three-man crew on a 7-day mission, and that there was no decrement in performance resulting from the long mission time. Because of the onboard exercise program, there was no deterioration of physical condition, and the pilots' alertness remained high throughout the mission. (From the authors' summary)

901
Mammen, R. E.,
G. T. Critz, D. W. Dery, F. M. Highly, and E. Hendler
EVALUATION OF PROPOSED GEMINI ENVIRONMENTAL PROFILE: THE EFFECT OF SEQUENTIAL EXPOSURE TO ACCELERATION AND THE GASEOUS ENVIRONMENT OF THE SPACE CAPSULE UPON THE PHYSIOLOGIC ADAPTATION OF MAN.—Naval Air Material Center, Air Crew Equipment Lab., Philadelphia, Pa. (Problem Assignment no. 005-AE13-15). Report no. NAEC-ACEL-498, June 14, 1963. vi+15 p., 8 tables, 10 figures, 1 appendix.

The following test conditions were established to simulate an orbital space flight with continuous exposure to 100% oxygen at 258 mm. Hg pressure: two 7 peak-g pulses in the profile as launch acceleration, chamber confinement for 14 days as orbit phase, and one 11.2 peak-g profile as re-entry acceleration. Of six aviators used as subjects, three were exposed to the complete test conditions, and three were exposed to the launch acceleration profile and 13, 12, and 11 days, respectively, of the orbit phase. No untoward physiologic effects due to the test conditions were observed, with the exception of reversible visual impairment, some chest discomfort, and serous aerotitis. Occurrence of a fire within the test chamber ended the study prematurely. (Authors' abstract) (46 references)

902
MANNED SPACE FLIGHT PROGRAM OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION: PROJECTS MERCURY, GEMINI, AND APOLLO. — U. S. Senate, 87th Congress, 2nd Session. Report of the Senate Committee on Aeronautical and Space Sciences, Sept. 4, 1962. vii+242 p.

The major program areas in aerospace medicine within the manned space flight program which are considered research areas are: (1) the effects of acceleration and weightlessness on men, (2) the protection of men from the radiation to be encountered in space flight, (3) the development of life support systems and equipment to maintain flight crews in a state of health conducive to effective mission performance, (4) the medical selection and monitoring of flight crews, and (5) medical support of manned space flight operations. Described and illustrated are the over-all manned space flight program, and projects Mercury, Gemini, and Apollo. Included are appendixes of the Department of Defense manned space flight project X-20, sampling of the events in the U. S. space program, and a subject index.

903
Marchbanks, V. H.,
H. B. Hale, and J. P. Ellis
STRESS RESPONSES OF PILOTS FLYING 6-HOUR OVERWATER MISSIONS IN F-100 AND F-104 AIRCRAFT. — School of Aerospace Medicine, Brooks

Air Force Base, Tex. (Project no. 7758, Task no. 59579). Technical Documentary Report no. SAM-TDR-62-112, Aug. 1962. iii+6 p.

From postflight urine and blood samples, stress was appraised in two groups of pilots flying over-water missions of 6 hours' duration in F-100 or F-104 aircraft. Control determinations were made on a third group of pilots on an off-duty day. Urinary determinations included epinephrine, norepinephrine, corticosteroids (17-OHCS), sodium, potassium, inorganic phosphate, urea, uric acid, and creatinine. Blood determinations included free and conjugated hydrocortisone and corticosterone-like fractions. Flying raised corticosteroid levels in plasma but not in urine. Levels for the F-100 group were higher than for the F-104. Urinary epinephrine and norepinephrine values for the flying groups were significantly above those for the control, values for the F-104 group exceeding those for the F-100. Differences in flying groups appear to relate to aircraft characteristics, weather conditions, and flying experience. Both flying groups showed high urinary excretion of urea and uric acid, but only in the F-104 group was sodium and potassium excretion elevated. Flying induced no variation in urinary phosphate. Singly and collectively, these determinations are basic to future studies on flight stress. (Authors' abstract)

904
Mazza, G.
[RECENT ADVANCES IN VESTIBULAR PHYSIOLOGY AND PHYSIOPATHOLOGY IN SPACE FLIGHT] Nuove acquisizioni di fisiologia e fisiopatologia vestibolare nel volo spaziale.—Rivista di medicina aeronautica e spaziale (Roma), 26 (1): 99-136. Jan.-March 1963. In Italian, with English summary (p. 130).

Various functions of the labyrinth are reviewed and the reactions of this organ to different accelerations described. The vestibular portion of the labyrinth is involved in the three phases of space flight (launching, orbital flight, reentry) and is the basis of the principal physiological phenomena of disorientation, motor incoordination, and neurovegetative distrubances that affect the astronaut. After a review of the accelerative phases of space flight, weightlessness, which represents the intermediate phase of flight is considered in detail. A neurovegetative disorientation syndrome, the so-called satellite sickness, is described. This syndrome is not affected by training. Several vestibular problems (abnormal otolithic excitation, coriolis acceleration causing vestibular dysfunction, sense of malbeing, nausea, pallor, etc.) are discussed which arise during prolonged interplanetary flight in an artificial gravity field. An appendix is included describing the principle techniques for creating simulated sub- or zero-gravity conditions such as immersion of body in water, parabolic flight, subgravity tower. (85 references)

905
Mercier, A.
[VISION IN TODAY'S AVIATION] La vision dans l'aviation d'aujourd'hui. — In: Visual problems in aviation medicine, p. 1-16. Ed. by A. Mercier. Oxford: Pergamon Press, 1962. In French, with English summary (p. 15-16).

High-performance jet aircraft may cause marked visual problems in pilots. The pilot's psycho-physiological balance should be examined periodically in order to prevent the appearance of sensory illusions and to combat any emotional shock resulting from lonely flight in an empty sky. Verifying a 10/10 visual acuity and emmetropia at the initial examination no longer assures the pilot safety of vision in all circumstances because of space myopia which appears in an empty visual field. Eye protection against dazzle is a problem as the altitude increases. Goggles, visors, and tinted glass canopies must have at least a 75% absorption coefficient. Higher landing speeds and the increasing use of helicopters give new importance to oculomotor equilibrium and stereoscopic vision. Whether aircrews constantly wear an oxygen-breathing apparatus, or fly in pressurized-cockpit planes, the oxygen supply must be carefully controlled because the first effect of anoxia is visual disturbance. Training in and control of night and twilight vision are recommended to ensure visual efficiency in flight. (Author's summary, modified) (54 references)

906
Mercier, A.,
and G. Perdriel
[VISUAL PROBLEMS IN LOW-ALTITUDE FLIGHT] Les problèmes visuels dans le vol à basse altitude. — In: Visual problems in aviation medicine, p. 78-83. Ed. by A. Mercier. Oxford: Pergamon Press, 1962. In French, with English summary (p. 83).

Low-altitude, high-speed flight requires increased attention which produces a nervous tension. Turbulence and acceleration near the ground are factors that contribute to visual impairment. The detection of ground targets is more difficult while flying at high speed and low altitude because visual acuity depends essentially upon sensory-psychomotor chronology. Meteorological conditions, the nature of the region flown over, and the time of the flight have an effect upon target detection. Training can improve flying under these conditions. Variations of lighting inside and outside the cockpit also affect vision. At low altitudes, detection of another aircraft becomes more difficult. Heat, vibrations, twilight, or night flying also cause visual disturbances. (Authors' summary, modified)

907
Mercier, A.,
and E. Lafontaine
[VISUAL FATIGUE OF COMMERCIAL AVIATION CREWS] La fatigue visuelle des équipages de l'aviation commerciale.—Presse médicale (Paris), 70 (43): 2025-2026. Oct. 13, 1962. In French.

The causes of visual fatigue in the commercial aircrew are discussed in two aspects: ocular factors (glare, instrument reading, accommodation stresses), and general factors (physiological changes caused by alterations of the nycthemeral rhythm, climate, altitude; emotional aggressions, fatigue). Ocular fatigue may be prevented or reduced by the use of tinted glasses, re-arrangement and rational illumination of cockpit flight instruments, following of general rules of hygiene, and providing time for rest.

908
Mercier, A.,
G. Perdriel, and G. Raynaud
[THE METHODS OF STUDYING VISUAL FATIGUE IN THE AVIATOR] Les procédés d'étude de la fatigue visuelle de l'aviateur—Revue de médecine aéronautique (Paris), 2 (7): 224-225, May-June 1963. In French.

Visual fatigue is recognized by the symptoms of orbital or periorbital headache, sensation of ocular heaviness, accompanied in many cases by conjunctival hyperemia and blinking. Visual fatigue can decrease visual capacity, especially for reading, visual acuity, space perception, and color discrimination which are very important in flying. Certain aeronautical factors can affect vision such as anoxemia, atmospheric decompression, noise, and vibrations. Dazzle at high altitudes has a negative effect on the quality and rapidity of visual accommodation. Visual fatigue is different according to the flight conditions and specialty of the flying personnel. In fighter aircraft it appears only after multiple high-altitude missions, and pilots of transport planes equipped with new instruments may experience fatigue which will decrease with adaptation to the new conditions. It is important to detect visual fatigue in order to prevent the appearance of abnormal visual conditions, especially in visual accommodation and binocular vision. Various tests used include measurement of heterophoria, study of the convergence/divergence ratio, examination with the synoptophore, scotoptometry, electroretinograph, and electroencephalograph. Comparison of the results obtained with different tests is of value in evaluating visual fatigue.

909
Merz, M.
[EFFECT OF FLIGHT IN MODERN AIRCRAFT ON THE VISUAL APPARATUS] Wpływ warunków współczesnego lotu na narząd wzroku. —— Lekarz wojskowy (Warszawa), 38 (4): 311-317. 1962. In Polish, with French summary (p. 317).

High-altitude, high-speed flight affects the visual apparatus, nervous system, and circulatory system. Special consideration is given to the eye as affected by supersonic speeds, accelerations, high altitudes, hypoxia, and sensory disorders. (Author's summary, modified)

910
Mickey, G. H.
ELECTROMAGNETISM AND ITS EFFECT ON THE ORGANISM. —— New York State Jour. Med., 63 (13): 1935-1942. July 1, 1963.

The exploration of space presents many problems other than the logistics of fuel, food, and atmosphere. Earthly organisms have evolved in and beneath a protective atmosphere and magnetic shield. When man soars beyond the layers of this atmospheric blanket and magnetic shield, he must devise artificial means of protecting himself against such factors as meteoritic encounters, weightlessness, lack of oxygen, and excess carbon dioxide and especially against the various electromagnetic radiations and high-energy particles of space. (Author's abstract)

911
Minners, H. A.,
S. C. White, W. K. Douglas, E. C. Knoblock, and A. Graybiel
CLINICAL AEROMEDICAL OBSERVATIONS. —— In: Results of the second United States manned orbital space flight, May 24, 1962, p. 43-53. Washington, D. C.: National Aeronautics and Space Administration, 1962.

A review of the detailed medical examinations on two astronauts who experienced approximately 4 1/2 hours of weightless space flight reveals neither physical nor biochemical evidence of any detrimental effect. Specifically, no pulmonary atelectasis, cosmic ray damage, or psychiatric abnormalities were found. In spite of directed efforts to stimulate the pilot's orientation and balancing mechanisms during weightless flight, no abnormal vestibular nor related gastrointestinal symptoms occurred. Postflight special labyrinthine tests confirmed an unchanged integrity of the pilots' vestibular system. Biochemical analyses after astronaut M. Scott Carpenter's flight confirmed the occurrence of moderate diuresis. Included are representative medical and biochemical tables. If heat stress continues to be a part of space flight, adequate fluid intake during the mission is necessary for crew performance and safety. (Authors' summary, modified)

912
Mori, T.,
and T. Kurokawa
[THE EFFECT OF JET PLANES ON THE ABDOMINAL ORGANS. I. MORPHOLOGICAL CHANGES OF THE STOMACH] [Abstract]. —— In: Abstracts of the 7th Meeting of the National Defense Medical Society. Bōei Eisei (National Defense Medical Journal) (Tokyo), 9 (3): 105. March 1962. In Japanese.

Stomach X-rays of T-33 and F86F jet pilots revealed a prevailing occurrence of gastroptosis. The condition is believed to be caused by abrupt changes in atmospheric pressure, velocity, and g-force. This was shown by the fact that the pilots of the F86F had a higher incidence rate of gastroptosis than the pilots of the T-33. Some of the student pilots examined before enrollment and after completing 120 hours of flying were found to have gastroptosis. From these data one may conclude that not only the stomach but other abdominal organs are subject to the effect.

913
Okubo, S.,
H. Fukuda, K. Ozeki, T. Nagami, and K. Goshi
[EFFECT OF SOUND AND COLOR ON THE HEART BEAT RATE OF THE RAT] Oto narabini iro no shinzo hakudosu ni taisuru eikoyo ni tsuite—Med. and Biology (Tokyo), 63 (5): 121-125. June 5, 1962. In Japanese.

Rats in a shielded box were stimulated intermittently with a 1000-cycle vibrator (intensity of 40, 60, or 100 phon) or with a color light projector (100, 250, or 500 watts). The heart rate increased as a result of noise stimulation, and decreased upon color stimulation. The effect of color depended on the type of color, the place, time, and intensity.

914
Palmer, J. O.
ALTERATIONS IN RORSCHACH'S EXPERIENCE BALANCE UNDER CONDITIONS OF FOOD AND SLEEP DEPRIVATION: A CONSTRUCT VALIDATION STUDY.—Jour. Projective Techniques and Personality Assessment, 27 (2): 208-213. June 1963.

In the first experiment two young, adult male subjects and a control were deprived entirely of food for 96 hours, during which time the Rorschach was administered twice daily. In a second session of 120 hours of food deprivation, the Holtzman ink blots were administered, 15 cards each day, to three subjects and a control. Third, the Holtzman blots were similarly given to four subjects deprived of sleep for 120 hours. Prima facie, both food and sleep deprivation were assumed to be external stress; thus an increase in color responses, i.e. an extratensive shift was predicted. Results showed no change in the first food deprivation group, a definite shift toward extratension during the second food deprivation, and a marked intratensive shift during sleep deprivation. The clinical behavior of these subjects during each experiment indicates that each group held distinctively different attitudes toward the stress. The first food-deprived subjects were "stoics", resistant to all change in their behavior; the second food-deprived subjects passively accepted the stress as externally imposed; and the sleep-deprivation subjects became personally involved in testing their endurance. (Author's summary, modified)

915
Parin, V. V.,
and O. G. Gazenko
SOVIET EXPERIMENTS AIMED AT INVESTIGATING THE INFLUENCE OF SPACE FLIGHT FACTORS ON THE PHYSIOLOGY OF ANIMALS AND MAN.—In: Life sciences and space research, p. 113-127. Ed. by R. B. Livingston and others. Amsterdam: North-Holland Publishing Co., 1963.

Results are given of biogolical experiments on space ship-satellites II, III, IV, and V, and of scientific investigations made during the flights of Gagarin and Titov aboard Vostok I and Vostok II. Physiological reactions to the flight stress factors were not pathological, but revealed peculiarities which deserve further study. In the post-flight period no alterations in health conditions of either cosmonauts or animals were observed. The most important tasks which remain to be studied are: the influence of protracted weightlessness, the biological action of space radiation, the action of acceleration stress after prolonged stay under zero-gravity conditions and also the analysis of the combined space flight factors, including emotional strain, on the organism. (Authors' abstract, in part)

916
Petrukhin, V. G.
[PATHOLOGICAL CHANGES IN THE INTERNAL ORGANS OF ANIMALS UNDER THE INFLUENCE OF FLIGHT ON SPACESHIPS] Patomorfologicheskie izmeneniia vnutrennykh organov zhivotnykh pod vliianiem poleta na kosmicheskikh korabliakh-sputnikakh.—Problemy kosmicheskoi biologii (Moskva), 2: 128-139. 1962. In Russian, with English summary (p. 139).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 123-135. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Morphological investigations of the seventy-two laboratory animals that made flights on board the artifical satellites II, IV, and V show certain mostly reversible dystrophic changes in various organs. Signs indicative of the development of the general adaptation syndrome (Selye's stress syndrome) were found. Dystrophic processes which disappeared after varying time intervals after the flight were found in liver, myocardium, and brain, i.e., focal protein and fat dystrophy of cardiac muscle fibers; granular, vacuolar, and fat dystrophy of liver cells; and anoxia injuries to the ganglion cells in cerebellum, Ammon's horn, and cerebral cortex. Hemopoietic disturbances were seen in the spleen. These changes are very similar to those described after impairment of hemodynamics in the whole organism.

917
PHYSIOLOGY OF MAN IN SPACE. — Edited by J. H. U. Brown. xiii+348 p. New York and London: Academic Press, 1963.

The topics considered by different authors are: maintenance of life in an enclosed system under adverse conditions; instrumentation in bio-medical capsules; cardiovascular, respiratory, and muscular responses to changes in gravity; hazards of radiation exposure; and phychological problems. Each chapter is abstracted separately, see items no. 85, 845, 849, 875, 999, 1055, 1817, 2310.

918
Pineau, P.,
and G. Juin
[STUDY OF VARIATIONS OF ARTERIAL PRESSURE IN JET B 707 FLIGHT PERSONNEL AND FLIGHT PERSONNEL OF CONVENTIONAL AIRCRAFT DC 6 and DC 7] Étude des variations de la tension artérielle chez les équipages d'avions à réaction B 707 et chez les équipages d'avions conventionnels DC 6 et DC 7.—Revue de médecine aéronautique (Paris), 2 (5): 11-16. Nov.-Dec. 1962. In French.

A preliminary, comparative study of arterial blood pressure was made between flight personnel of jet Boeing 707 (11 groups) and personnel of conventional DC-6 and DC-7 aircraft (1 group each) after normal flight duty. The results included: (1) an age factor (slight hypertension found in personnel nearing 50 years of age); (2) no sex factor; and (3) slight hypertension after second flight (less than 48 hours between both flights). After jet flights, arterial tension varied with individuals but there was a general lowering of systolic tension an an increase in diastolic tension. On conventional airplane flights only negligible differences in blood pressure were found.

919
Rohles, F. H.,
M. E. Grunzke, and H. H. Reynolds
CHIMPANZEE PERFORMANCE DURING THE BALLISTIC AND ORBITAL PROJECT MERCURY

FLIGHTS. — Jour. Compar. and Physiol. Psychol. 56 (1): 2-10. Feb. 1963.

In the first flight the subject was placed through a ballistic trajectory and during the flight had to perform a continuous and discrete avoidance task. During the second flight, in which the capsule orbited the earth twice, a chimpanzee had to perform a complex multiple operant task. On the basis of these flights, it was concluded that accelerations accompanying launch and re-entry in excess of 7 g had an immediate effect upon performance; however, recovery to a prelaunch level appeared to be rapid. Performance decrements did not occur during weightlessness. Eating and drinking were accomplished during weightlessness without difficulty. The visual processes, as measured, were unaffected by the rigors of space flight; this was also true of temporal response processes as well as continuous and discrete motor behavior. (Authors' summary and conclusions)

920
Rohles, F. H.,
G. V. Pegram, H. H. Reynolds, M. E. Grunzke, and D. N. Farrer
A COMPLEX AVOIDANCE SCHEDULE FOR STRESS AND DRUG RESEARCH WITH PRIMATES.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6893, Tasks no. 689301 and no. 689302). Technical Documentary Report no. ARL-TDR-63-16, May 1963. iv+9 p.

Previous research has suggested that performance under extreme stress may persist more readily under negative reinforcement than under positive reinforcement. Therefore, certain performance tasks have been integrated to give a complex avoidance schedule which provides for the measurement of simple motor behavior, discrete auditory and visual response latency, and discriminatory response latency to visual stimuli. Representative performance records of the chimpanzee and monkey are given, with likenesses and differences pointed out. It is hoped that this and other complex schedules under the control of negative reinforcement will prove of value in evaluating behavior under stress and drug conditions. (Authors' abstract)

921
Ruff, G. E.
PSYCHOLOGICAL AND PSYCHOPHYSIOLOGICAL INDICES OF STRESS.—In: Unusual environments and human behavior, p. 33-59. Ed. by N. M. Burns and others, London: Collier-Macmillan Ltd., 1963.

The problems of developing psychological indexes of stress are discussed in the light of stress as initiating physiological and psychological compensatory mechanisms. A preliminary model is offered in which stress inputs to the system are evaluated in terms of the behavioral and physiological outputs. The psychological measures include tests of motor, perceptual, cognitive, and emotional responses. Psychophysiological measures of the sympathetic nervous system, pituitary-adrenal function, and the cerebral cortex activity are discussed. The results of many experimental papers are organized in a theoretical schema. (76 references)

922
Ryan, E. D.
EFFECTS OF STRESS ON MOTOR PERFORMANCE AND LEARNING. — Research Quarterly, 33 (1): 111-119. March 1962.

Male college students were tested on a motor learning task that involved balancing for 12 trials on the pivoted platform of a stabilometer. The task was made easy for 40 of the subjects by placing the platform 10 in. below the pivot and made difficult for 80 of the subjects by placing it 10 in. above the pivot. Half of the easy task subjects were given electric shocks irregularly during the learning period to produce tension. Their performance or learning did not differ appreciably from the control subjects. Under the same conditions, except that difficult task was used, the experimental subjects achieved the same amount of learning as the controls but showed poorer performance throughout the test. When the application of the tension-producing shock was delayed until the third trial, it produced a lesser amount of performance impairment for that trial but full impairment for later trials. The results support the hypothesis (based on earlier studies) that increased tension impairs performance of a difficult motor task and that rate of learning is independent of the state of tension for either difficult or easy skills – except that predicted better performance under tension for the easy task did not occur. (Author's abstract)

923
Semenenko, V. E.,
and M. G. Vladimirova
[THE EFFECTS OF SPACE-FLIGHT CONDITIONS ON VIABILITY RETENTION OF A CHLORELLA CULTURE] Vliianie uslovii kosmicheskogo poleta na korable-sputnike na sokhranenie zhiznesposobnosti kul'tury khlorelly. — Problemy kosmicheskoi biologii (Moskva), 1: 190-204. 1962. In Russian, with English summary (p. 204).

Cultures of Chlorella pyrenoidosa, after a 24-hour-long space flight, retained their viability and did not show any irreversible changes in physiological processes such as photosynthesis, growth, development, and reproduction. Immediately after return to Earth, the cultures exhibited lowered photosynthetic activity, and a significant number of destroyed cells were found. After six days under active conditions, the retrieved algae completely approached the controls and normal cultures.

924
Shakhov, A. A.,
S. A. Stanko, and V. S. Khazanov
[THE SPACE FLIGHT SIGNIFICANCE OF PHOTOADAPTATION AND PHOTOREACTIVATION OF PLANT ORGANISMS] Kosmicheskoe znachenie fotoadaptatsii i fotoreaktivatsii u rastitel'nykh organizmov.—Problemy kosmicheskoi biologii (Moskva), 2: 340-353. 1962. In Russian, with English summary (p. 352-3).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 349-361. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Mountain environment at altitudes of 4000-5000 meters above sea level, is characterized by unique "quasi-cosmic" gas and radiation conditions (high degree of solar radiation, strong ultra-violet radiation, sharp diurnal temperature fluctuations, low atmospheric pressure, reduced CO_2 content, and oxygen deficiency). Leaves of plants in the Pamirs (3860 m.) actively absorb photons over the entire spectrum—from ultraviolet to infrared. These plants utilize the powerful flow of radiation to offset the damaging effect of short-wave ultraviolet rays. Through adaptation by generations they can increase the absorption of luminous energy (photoadaptation) and repair injuries caused by UV radiation (photoreactivation). Thus the absorption of radiant energy by barley leaves in the wavelength range of 430-1000 milimicra has increased to as much as 15,000 ergs/cm^2/sec. The restoration of injuries caused in the chloroplasts by the UV rays is in proportion to the photoreactivation ability of the plant. Due to photoreactivation the submicroscopic structure shows no pathologic alterations. If photoadaptation and photoreactivation are at work, the plant can reduce carbon dioxide under strong ultraviolet irradiation in the cabin of a space ship. The value of these processes for space navigation depends therefore on whether they can take place in the closed ecological environment presented by a space ship cabin subjected to the radiation conditions prevailing in outer space. (From the authors' summary)

925
Sidorov, B. N.,
and N. N. Sokolov
[EFFECT OF SPACE FLIGHT ON THE SEEDS OF ALLIUM FISTULOSUM AND NIGELLA DAMASCENA] Vliianie uslovii kosmicheskogo poleta na semena Allium fistulosum (luk-batuh) i Nigella damascena (chernushka).—Problemy kosmicheskoi biologii (Moskva), 1: 248-251. 1962. In Russian, with English summary (p. 251).

Dry seeds of the radiation-sensitive Allium fistulosum and radiation-resistant Nigella damascena were carried on the orbital flight of Sputnik-2. Comparison with controls failed to show any effect on the frequency of chromosomal rearrangements or the rate of germination. It was evident, however, that the growth vigor of the experimental seeds was higher than that of the controls.

926
Sisakian, N. M.,
V. V. Parin, V. N. Chernigovskii, and V. I. Iazdovskii
[SOME PROBLEMS OF SPACE STUDY AND EXPLORATION] Nekotorye problemy izucheniia i osvoeniia kosmicheskogo prostranstva. — Problemy kosmicheskoi biologii (Moskva), 1: 5-16. 1962. In Russian, with English summary (p. 16).

It is inevitable that mankind will establish itself in the cosmos. Therefore a whole series of practical and theoretical problems have to be solved. These could be divided into three preliminary groups: problems associated with the flight dynamics, problems characterizing the space environment, and problems of a prolonged existence outside terrestrial confines. The solution of all these problems will have a tremendous impact upon the future of mankind.

927
Sisakian, N. M.
V. V. Parin, V. N. Chernigovskii, and V. I. Iazdovskii
[PROBLEMS OF SPACE BIOLOGY AND PHYSIOLOGY] Problemy kosmicheskoi biologii i fiziologii.—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1962 (2): 153-162. March-April 1962. In Russian.

The authors present a general discussion of space biology in the light of available information. In their view, three fundamental tasks have to be carried out: (1) a study of the effects of space flights on terrestrial organisms; (2) the development of broad biological principles to insure safety of man and animals during space flights, and during their presence on other planets; and (3) the study of extraterrestrial life. The authors conclude that space biology could provide important information on the origin of life.

928
Smith, George B.
ENVIRONMENTAL BIOLOGY. — In: Proceedings of the NASA-University conference on the science and technology of space exploration, vol. 1, p. 395-398. Washington, D. C.: National Aeronautics and Space Administration, Dec. 1962.

Environmental factors in space flight and their effects on man are discussed as they relate to promoting and maintaining man's efficiency for prolonged flight durations. The following are included: (1) biodynamics, involving noise and vibrations, sustained accelerations and impacts, and the effects of weightlessness; (2) radiations from the sun, the stars, the Van Allen belt, and nuclear-reactor propulsion or power systems; (3) life support, consisting of providing food, water, oxygen, etc.; and (4) medical selection and maintenance. The National Aeronautics and Space Administration has used the skills of various federal agencies, the academic world, and industry, as well as its own centers in these endeavors.

929
Stapp, J. P.
MEDICAL PROBLEMS OF SPACE FLIGHT. — Jour. Mississippi State Med. Assoc., 3 (9): 404-412. Sept. 1962.

The Mercury space flight program methods for selecting, training, and physiologically adapting the astronaut for space flight are briefly reviewed. Discussion is presented of the preparation for both suborbital and orbital flight, flight observations of astronauts Shepard and Grissom (suborbital flight), and Glenn (orbital flight). Analysis of flight data and postflight examination were found to be normal except for changes comparable to the results of exertion in an athletic event of about the same intensity and duration.

930
Ulvedal, F.,
Woodard R. Smith, and B. E. Welch
STEROID AND CATECHOLAMINE STUDIES ON PILOTS DURING PROLONGED EXPERIMENTS IN A SPACE CABIN SIMULATOR.—School of Aerospace Medicine, Brooks Air Force Base, Tex.

(Task no. 793002). Technical Documentary Report no. SAM-TDR-63-53, July 1963. iii+12 p.

Urinary excretion of 17-hydroxycorticosteroids, corticosterone-like hormones, and catecholoamines was investigated in pilots during prolonged experiments in a two-man space cabin simulator. The experimental profiles were: (1) two 17-day experiments at ground level; (2) two 14-day experiments at 27,000 feet; and (3) four 17-day experiments at 33,500 feet. In the latter two groups, the atmosphere was essentially 100% O_2. The hormone parameters indicate that conditions imposed by the experimental procedures were no more stressful to the subjects than undergoing extensive medical examinations, as observed from pre-experimental and postexperimental values. The only significant trend was the continuous linear increase in the excretion of corticosterone-like hormones. Extraordinary occurrences in the simulator were correlated with increased catecholamine and steroid excretion. The correlation coefficients and the analyses of variance for the four hormone parameters were calculated and discussed. (Authors' abstract)

931
UNUSUAL ENVIRONMENTS AND HUMAN BEHAVIOR: PHYSIOLOGICAL AND PSYCHOLOGICAL PROBLEMS OF MAN IN SPACE.—Edited by N. M. Burns and others. x+438 p. London: Collier-Macmillan Ltd., 1963.

The purpose of this book is to describe the ranges of environmental variables in space flight, man's adaptation to them, and the effects of exposure to them. The first five chapters by various authors, are concerned with the general problems of the human organism's response to unusual environmental conditions, and include the physiological mechanisms that operate to maintain homeostasis under environmental environmental stresses; psychological and psychophysiological indexes of stress; computer simulation of man-machine systems; psychological problems in closed ecological systems; and psychophysiology of high-altitude experience. The next six chapters deal with specific problem areas such as isolation and sensory deprivation, acceleration, temperature regulation, weightlessness, vibration, and the effects of radiation on integrated behavior. In the concluding remarks, the editors consider some methodological problems which remain to be solved and some social problems brought about by the rapid advance of space science. Each chapter is abstracted separately, see items no. 77, 892, 921, 949, 1062, 1143, 1295, 1425, 1569, 1614, 1715, 2194.

932
Volynkin, IU. M.,
V. V. Parin, and V. I. Iazdovskii
[PRELIMINARY DATA ON PHYSIOLOGICAL STUDIES DURING HUMAN FLIGHT INTO SPACE] Predvaritel'nye dannye o fiziologicheskikh issledovaniiakh pri polete cheloveka v kosmos.—Problemy kosmicheskoi biologii (Moskva), 2: 7-10. 1962. In Russian, with English summary (p. 10).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 5-8. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437).

The main stages in the development of space-flight physiology are outlined. The authors discuss the principles and methods of the selection and training of the first Soviet cosmonauts, as well as before- and after-flight investigations and methods of monitoring their condition during the flight. The preliminary results of physiological researches conducted in the first two manned space flights are presented. (From the authors' summary)

933
Volynkin, IU. M.
and P. P. Saksonov
[MEDICO-BIOLOGICAL STUDIES OF SPACE-FLIGHT FACTORS] Mediko-biologicheskie issledovaniia faktorov kosmicheskikh poletov.—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1963 (3): 405-418. May-June 1963. In Russian, with English summary (p. 418).

All known physiologically active agents encountered by man in outer space could be subdivided into three classes as follows: purely physical factors of the environment such as radiation, temperature contrasts, barometric pressure, etc.; dynamics of the rocket flight; and factors characterizing life aboard a space ship. The authors present a discussion of the above mentioned factors in the light of published aerospace data. No original research information is included. (26 references)

934
Zhukov-Verezhnikov, N. N.,
I. N. Maiskii, V. I. Iazdovskii, and others
RESULTS OF FIRST MICROBIOLOGICAL AND CYTOLOGICAL EXPERIMENTS ON EARTH SATELLITES IN SPACE.—Artificial Earth Satellites (Consultants Bureau, New York), 11: 47-71. Sept. 1962.

English translation of: Itogi pervykh mikrobiologicheskikh i tsitologicheskikh eksperimentov v kosmicheskom prostranstve na sputnikakh zemli.—Iskusstvenye sputniki zemli (Moskva): 11: 44-67. 1961. In Russian.

A summary is presented of the results of microbiological and cytological investigations of life conditions in space and the genetic effects of space flight. The following facts were established: (1) Exposed pieces of skin could be cultured after return from space; regrafts of space-exposed samples to their donors took as well as control samples. (2) HeLa cancer cells cultured after return from space showed the same dead cell/living cell ratio; there were no immunological or morphological differences between the experimental samples and controls. (3) Telemetered information on the activity in cultures of butyric acid bacteria proved to be of practical value in ascertaining effects of long-term exposure to space. (4) No genetic changes were found in exposed *Escherichia coli* K-12 and *Aerobacter aerogenes* cultures; phage production by the former was increased only slightly. (5) After exposure of calf-thymus DNA no changes were found in the optical density of solutions, thermal stability, antigenic, or serologic properties. On flights in orbits similar to the orbit of Vostok-1 there were practically no effects of factors capable of primary action on isolated cells.

935
Zhukov-Verezhnikov, N. N.,
I. N. Maiskii, V. I. Iazdovskii, A. P. Pekhov, N. I. Pybakov, N. N. Klemparskaia, A. A. Giurdzhian, G. P. Tribulev, N. P. Nefed'eva, M. M. Kapichnikov, I. I. Podoplelov, V. V. Antipov, I. S. Novikova, and V. Ia. Kop'ev
[PROBLEMS OF SPACE MICROBIOLOGY AND CYTOLOGY] Problemy kosmicheskoi mikrobiologii i tsitologii.—Problemy kosmicheskoi biologii (Moskva), 1: 118-136. 1962. In Russian, with English summary (p. 135-136).

Experiments conducted in the USSR on the effects of space flight on microorganisms, tissue cultures, and skin explants are reviewed. Monolayers of microbial cultures retained their viability. Cultures of human tissue showed after flight exposure normal growth, reproduction rates, morphology, and antigenic properties. Human skin explants, carried on Vostok-1 and -2, retained their viability after autotransplantation. The authors suggest that in the future lysogenic bacteria should become an important tool in studies of genetic effects of space flights. (28 references)

936
Zhukov-Verezhnikov, N. N.,
I. N. Maiskii, V. I. Iazdovskii, A. P. Pekhov, A. A. Giurdzhian, N. I. Rybakov, and V. V. Antipov
[MICROBIOLOGICAL AND CYTOLOGICAL STUDIES ON SPACESHIPS] Mikrobiologicheskie i tsitologicheskie issledovaniia na kosmicheskikh korabliakh.—Problemy kosmicheskoi biologii (Moskva), 2: 140-148. 1962. In Russian, with English summary (p. 147-8).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 148-155. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

In early flights of Russian space vehicles microbial cells and bacteriophages, cultures of Hela cancer cells, fibroblasts, and amnion cells had been included; they did not differ from the controls. Preserved human skin scraps were successfully reimplanted to their donors after the flight. These findings indicate an absence of cell-damaging factors along the orbits studied. Exploratory satellite flights along the orbits later flown by IU. Gagarin and G. Titov showed no factors damaging to lysogenic bacteria or raising the rate of auxotrophic mutations in Escherichia coli cultures. However, bacterial cultures in G. Titov's cabin showed a slight increase in phage particles and in the intensity of the dissociation process.

b. Acceleration

937
Barer, A. S.
[THE AFTER-EFFECT OF SINGLE OR REPEATED CENTRIPETAL ACCELERATIONS ON THE HIGHER NERVOUS ACTIVITY OF ANIMALS] Vliianie odnokratno i mnogokratno deistvuiushchikh tsentrostremitel'nykh uskorenii na vysshuiu nervnuiu deiatel'nost' zhivotnykh v posledeistvii. — Zhurnal vysshei nervnoi deiatel'nosti (Moskva), 12 (2): 332-337. March-April, 1962. In Russian, with English summary (p. 337).

English translation by U. S. Joint Pub. Research Serv. (Washington), no. 14,796 (OTS: 62-11732), p. 16-30. Aug. 10, 1962. (Available from Office of Technical Services, U. S. Dept. Commerce)

Ninety-one rats were subjected to accelerations on a centrifuge at 4 g for 15 seconds, 7 g for 1 minute, and 10 g for 1 minute. Some animals were subjected to repeated accelerations. Their higher nervous activity was studied by means of complex food-conditioned motor reflexes. Disruption of the conditioned-reflex activity was related to the magnitude and direction of acceleration. The greatest changes were caused by accelerations in a head-pelvis direction, the least changes by accelerations acting in a transverse direction. This is in accord with the hypothesis that the effect of accelerative forces on the organism is determined by the change in the hemodynamics affecting the blood supply to vital organs. Central nervous system adaptation to repeated accelerations was noted.

938
Barer, A. S.
[LIMIT OF HUMAN TOLERANCE TO TRANSVERSE ACCELERATIONS AND THE PHYSIOLOGICAL REACTIONS OF THE BODY] Predel perenosimosti chelovekom poperechno deistvuiushchikh uskorenii i fiziologicheskie reaktsii organizma.—Problemy kosmicheskoi biologii (Moskva), 2: 255-272. 1962. In Russian, with English summary (p. 272).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 266-282. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Acceleration tolerance of subjects positioned at a 65° inclination to the direction of the acceleration force was studied on a centrifuge with an 8-meter radius. Average tolerances were: 6 g for 646 seconds, 8 g for 147 seconds, 10 g for 60 seconds, 12 g for 30 seconds, 14 g for 18 seconds, and 15 g for 10 seconds. The chief factors restricting the tolerance were disturbances in respiration and the cardiovascular system. A more extensive study was made of the cardiovascular system, respiration, motor coordination, bioelectrical activity of the brain, bioelectrical activity of various groups of skeletal muscles, and the subjective feelings of the individuals. The responses of the organism follow a sequence of definite phases which are most marked upon accelerations of 6-10 g. Acceleration tolerance of the organism in relation to this direction of the force can be raised primarily through an increase in the stability of the respiratory and cardiovascular systems.

939
Barr, P. O.
HYPOXEMIA IN MAN INDUCED BY PROLONGED $+G_z$ ACCELERATION.—Karolinska Institutet. Labs. of Aviation and Naval Medicine, Stockholm, Sweden (Contract AF 61(052)-153); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7220). Technical Documentary Report no. AMRL-TDR-61-137, April 1963. iii+11 p.

Changes in the arterial oxygen saturation were recorded in healthy subjects on the human centrifuge by continuous cuvette oximetry before, during, and after prolonged exposures to positive acceleration. With the subjects breathing air and wearing an automatically inflated anti-g suit, an immediate fall in the arterial O_2 saturation was observed upon exposure to +4.5 to 5.0 g. After one minute of the first exposure the O_2 saturation ranged between 95 and 81%, the arterial pH remaining essentially unchanged. At the same time the respiratory minute volume had increased, indicating gross deterioration in the efficiency of pulmonary function. Repeated exposures caused the arterial O_2 saturation to fall at a faster rate and to a lower level with each consecutive run. The rate of resaturation on returning to normal gravity was usually slow, and markedly so after several exposures. The last-mentioned observations are interpreted as being mainly the result of residual atelectasis in dependent regions of the lungs. The potential dangers of acceleration-induced hypoxemia in high-performance flight missions are discussed. (Author's abstract) (26 references)

940
Beckman, E. L.,
T. D. Duane, and K. R. Coburn
LIMITATION OF OCULAR MOTILITY AND PUPILLARY DILATATION IN HUMANS DURING POSITIVE ACCELERATION. — In: Visual problems in aviation medicine, p. 17-25. Ed. by A. Mercier. Oxford: Pergamon Press, 1962.

Fifty subjects from 18 to 55 years of age participated in a total of 350 centrifuge runs. During positive acceleration there occurred a limitation of ocular motility which could be overcome by voluntary effort, but the superseding movements were ataxic. The lower motor neurons to the extra-ocular muscles were not involved in the limitation of ocular motility. The pupils dilated as the visual fields constricted during positive acceleration and reached a maximum with loss of central vision. The optokinetic reflex did not continue during blackout. However, a form of horizontal nystagmoid movement of the globes persisted in eyes previously stimulated by the optokinetic drum. Vertical nystagmus was observed during high rates of change of positive acceleration. With a modified skin-diver mask, 30 mm. Hg negative pressure was applied to the orbit; under these conditions vision was restored, ataxic voluntary movements became coordinated, optokinetic reflexes were restored to original frequency, and the pupils remained partially dilated. The pupillary dilatation accompanying blackout was prevented by local application of pilocarpine and was unaffected by morphine. (Authors' summary and conclusions, modified)

941
Benson, A. J.
EFFECT OF LINEAR ACCELERATION ON LABYRINTHINE NYSTAGMUS IN MAN [Abstract]. —International Congress of Physiological Sciences, 22 (Leiden, 1962), Proceedings, vol. 2, no. 1016. Amsterdam [1962?].

Previous work suggests that the behavior of the cupula is in part dependent upon the linear accelerations to which it is exposed. This has been tested in experiments in which the subject sat, with the head vertical, at the end of a centrifuge arm in a fixed seat which faced towards the center, either 40° to the right or to left of the radius. From a base speed of 25°/sec. the centrifuge was accelerated to 105°/sec. (3.1 g) at 10°/sec.^{2} for 8 sec., held constant for 1 min. and then decelerated at 10°/sec.^{2} for 8 sec. Horizontal eye movements were recorded electronystagmographically with the eyes closed. The duration of the sensation of turning following the angular stimuli was not altered significantly by head position or the high linear acceleration. The angular velocity of the slow phase of nystagmus rose during the initial acceleration to peak values of 40°/sec. and 31°/sec. and during the subsequent 10 sec. decayed exponentially, the time constants being 10.0 sec. and 5.5 sec. with the head to the left and to the right, respectively. Over the following 6 sec. the decay was linear to give sustained nystagmus in which the direction of the slow phase corresponded with head position. Following deceleration the pattern of nystagmus was similar in either head position, the peak angular velocity was 43°/sec. and the decay time constant 11.4 sec., exponential for at least 30 sec. Thus there is further evidence which suggests that the behavior of the ampullary receptors may be modified by certain linear accelerations. (Author's abstract)

942
Bird, J. W. C.,
C. C. Wunder, N. Sandler, and C. H. Dodge
ANALYSIS OF MUSCULAR DEVELOPMENT OF MICE AT HIGH GRAVITY. — Amer. Jour. Physiol., 204 (3): 523-526. March 1963.

Although 4 g, as simulated by continual centrifugation, delays growth of the heart, diaphragm, and gastrocnemius muscles, some growth of these organs is possible at this gravitational field. Overall body growth actually suffers a more marked retardation than do these experimental organs. Results are given for mice whose exposure was initiated at the age of five weeks. The fractional water content was almost constant throughout, being only slightly lower in the experimental muscles. Analysis for noncollagen-nitrogen (NCN) was employed as an index of contractile and sarcoplasmic proteins. Throughout the experiment, concentration of NCN was below the control level in the diaphragm tissue. For the heart, the fraction was 26 ± 12% below normal after 2 weeks of centrifugation. However, the NCN concentrations were not measurably changed in the heart after 1, 4, and 8 weeks of centrifugation; moreover, throughout the experiment, there were no measurable changes of NCN concentration for the gastrocnemius muscles. Although muscular growth would be possible in a gravitational field exceeding the terrestrial intensity, some alteration in the type of musculature would be expected. (Authors' summary)

943
Bjurstedt, H.
EFFECTS OF PROLONGED EXPOSURE TO POSITIVE g LOADINGS ON THE PULMONARY GAS EXCHANGE.—In: Space research and technology, p. 10-11. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

The results of subjecting anesthetized dogs to prolonged g forces (on a centrifuge) in the head-to-tail direction (positive acceleration) are reported. In spite of the fact that the animals were hyperventilating and breathing 100% oxygen, hypoxemia was found, which was attributed to disturbances of ventilation and perfusion of the lungs. This kind of hypoxemia would exert the same deleterious effect on the central nervous system as does high-altitude hypoxemia, and might be equally deleterious from the performance point of view as alkalosis (hypocapnia), since hypocapnia would tend to decrease further the oxygen supply to the brain via vasoconstriction.

944
Briney, S. R.,
and C. C. Wunder
GROWTH OF HAMSTERS DURING CONTINUAL CENTRIFUGATION. —— Amer. Jour. Physiol., 202 (3): 461-464. March 1962.

Female Syrian hamsters were subjected to continual centrifugation for a period of 4 weeks at four or five times the earth's gravity. Animals were 5 weeks of age at the onset of exposures. Although an increased gravitational field curtails body growth, certain organs were found to show an increase in their relative mass when compared to control littermates. The heart, diaphragm, gastrocnemius muscle, lungs, kidney, and head showed a relative increase in mass, and the femur bones of centrifuged hamsters showed a relative increase in length. (Authors' abstract)

945
Cambeis, L.
BIBLIOGRAPHY OF IMPACT ACCELERATION LITERATURE: ANNEX TO SYNTHESIS OF IMPACT ACCELERATION TECHNOLOGY FOR AVIATION CRASH INJURY PREVENTION.— Flight Safety Foundation, Inc., New York, N. Y. (Contract DA 44-177-AMC-888(T)); issued by Army Transportation Command, Fort Eustis, Va. (Task no. 1AO24701A12101). TRECOM Technical Report no. 63-31B, June 1963. v+101 p.

An author/organizational list of bibliographic material resulting from Project SIAT (Synthesis of Impact Acceleration Technology) for aviation crash injury prevention is presented. The project was conducted by the Flight Safety Foundation, Inc., New York, New York. Most of the documents are physically located at Aviation Crash Injury Research (AvCIR), a Division of the Flight Safety Foundation, Inc., in Phoenix, Arizona. These documents are so indicated by an AvCIR reference number contained in parentheses at the end of the appropriate bibliographic reference. To obtain copies of the reports, recipients of this annex should contact the author or organizations responsible for preparing and printing them. Access to any of the documents located at AvCIR is authorized for qualified personnel visiting that establishment. (1037 references)

946
Caporale, R.
[BEHAVIOR OF SOME POSTURAL REFLEXES IN INTACT, LABYRINTHECTOMIZED, OR DECEREBRATED PIGEONS, DURING VARIATIONS OF ACCELERATIONS BETWEEN TWO AND ZERO G] Comportamento di alcuni riflessi posturali in colombi intatti, slabirintati o decerebrati, durante variazioni di accelerazioni tra due e zero g. —— Rivista di medicina aeronautica e spaziale (Roma), 25 (2): 243-256. April-June 1962. In Italian, with English summary (p. 254).

Cinematographic registration was made of static reflexes and posture kinetics (spontaneous posture, changes of head position in space, hop preparation reflex) of pigeons subjected to accelerations between 2 and 0 g in the subgravity tower. Intact pigeons displayed no significant changes due to subgravity. Decerebrated pigeons retained the hop preparation reflex and the capacity to fly; however, the static head reflex was weaker than that of intact animals. Totally labyrinthectomized pigeons demonstrated a disappearance of compensatory static reflexes, hop preparation reflex, and voluntary equilibration. Hemilabyrinthectomized animals retained normal posture similar to intact animals but tended to fly circularly around the intact side; the hop preparation reflex was retained while the compensatory head reflexes were missing.

947
Chaffee, J. W.
CHANGE IN HUMAN CENTER OF GRAVITY PRODUCED BY CHANGE IN DIRECTION OF ACCELERATION. —— ARS Journal, 32 (11): 1677-1680. Nov. 1962.

The two-dimensional location of the center of gravity of the seated human body was studied on 25 male subjects under conditions of experimentally controlled changes in the angle at which a 1-g acceleration acted upon the completely restrained body. It was found that varying the direction of the simulated acceleration vector from 15° through 80°, measured from the torso axis forward, produced: (1) a migration of the group average center of gravity along a curved path of 2.15-in. arc length; and (2) a consistent rotation of the axis of maximum individual variability (supposed "optimum" thrust vector) from 10° 53' aft of the torso axis to a maximum forward angle of 90° 16'. Speculation concerning the practical applications of these findings to the design of rocket-powered systems (e.g., escape capsules) is presented. (Author's summary)

948
Chambers, R. M.,
and L. Hitchcock
EFFECTS OF ACCELERATION ON PILOT PERFORMANCE.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Task MR005.13-1004.1, Report no. 8). Report no. NADC-MA-6219, March 26, 1963. [6]+ii+64 p.

This report attempts to consolidate the findings of both prior and recent research in the area of acceleration effects upon performance and to relate these findings to basic piloting behaviors. The decrements in the visual, psychomotor response, and intellectual processes which have been found to accompany acceleration stress are quantified where possible. Both transverse and positive accelerations have been shown to raise the level of contrast required for visual brightness and to reduce general acuity at acceleration loads well below those which result in gross visual impairment. Similar impairments in discrimination response rates are also discussed. The techniques thus far used to assess higher mental ability under acceleration are presented as are some of the problems which complicate such measurements. Data from such studies are presented to illustrate the reduction in immediate memory and information processing capabilities of pilots experiencing both high-level, short-term and moderate, extended accelerations. The known effects of acceleration upon the ability of pilots to "fly" both simple and whole-system simulations are cataloged with special attention given to the ways in which such variables as system complexity, controller construction, restraint and life-support equipments, and subject learning serve to augment or reduce these effects. (Authors' summary) (30 references)

949
Chambers, R. M.
OPERATOR PERFORMANCE IN ACCELERATION ENVIRONMENTS.—In: Unusual environments and human behavior, p. 193-319. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

Research findings on the effects of acceleration stress on human performance are reviewed. Findings on the effects of g on vestibular, kinesthetic, proprioception vision, hearing, and other senses are summarized. Reviews are also included of the ability of human subjects and pilots to perform simple and complex psychomotor tasks while exposed to various acceleration environments; the problems of measuring higher mental functioning during acceleration stress; acceleration effects on personality, emotional behavior, and motivation; error characteristics of performance impairment and their utilization and quantification; simulated space flight conditions; and some of the applications of the results of acceleration research to training and conditioning of human subjects, and the design of equipment for use within these environments. A series of performance tolerance maps along various dimensions of human ability would be invaluable in the design of space vehicles and the allocation of man-machine functions for proposed space vehicles. (Author's summary, modified) (237 references)

950
Chkhaidze, L. V.
[EFFECT OF CHANGES IN THE GRAVITATIONAL FIELD ON THE COORDINATION OF VOLUNTARY MOVEMENTS IN MAN] Vliianie izmenenii gravitatsionnogo polia na koordinatsiiu proizvol'nykh dvizhenii cheloveka.—Soobshcheniia Akademii nauk Gruzinskoi SSR (Tbilisi), 28 (5): 593-600. May 1962. In Russian.

Tensometric recordings were made of alternating finger pressures on a hard surface while the test subjects were exposed to transverse acceleration on a centrifuge. The accelerations employed were either stable at 3 or 7 g or were gradually increased from 0 to 7 g. The estimate of the motor coordination was based on differences in each pair of pressure exertions. With increased accelerations, there was a corresponding decline in motor coordination; the limits of perturbations in coordination were dependent on the extent of personal experience with accelerations, and were proportional to the logarithm of acceleration. Repetition of exercises during acceleration tended to improve the coordination performance, which in some instances was proportional to the time logarithm of the training. It is concluded that the results of this experiment could be used for testing the motor performance of individuals to be exposed to space flights.

951
Choi, H.
VARIATIONS OF ELECTROENCEPHALOGRAM OF RABBIT ELICITED BY POSITIVE RADIAL ACCELERATION.—Republic of Korea Air Force, Journal of Aviation Medicine (Seoul), 10 (1): 23-30. June 1962. In Korean, with English abstract (p. 30).

Five rabbits were exposed to positive radial acceleration of 5 g for a period of five minutes, and the electroencephalographic pattern using fronto-occipital leads was studied. The pattern of normal rabbits was composed mainly of a wave of 3-8 c.p.s. and 100-500 microvolts amplitude and a fast wave of about 15 c.p.s. with lower amplitude. Following exposure of one to three minutes, the main wave decreased in frequency and increased in amplitude. The fast wave decreased in both frequency and amplitude. Exposure for five minutes resulted in lowered wave amplitude and disappearance of fast waves. Heart rate decreased as time elapsed. At the end of five minutes of exposure, the heart rate decreased approximately one fourth of its original value. (Author's abstract, modified)

952
Clark, B.,
and A. Graybiel
VISUAL PERCEPTION OF THE HORIZONTAL DURING PROLONGED EXPOSURE TO RADIAL ACCELERATION ON A CENTRIFUGE. — Jour. Exper. Psychol., 63 (3): 294-301. 1962.

Visual perception of the horizontal was studied in four subjects during 4-hour periods of constant rotation in the Pensacola slow rotation room. They were subjected to a constant change in magnitude and direction of centripetal force so that they perceived the oculogravic illusion. The results show no significant, systematic changes in the oculogravic illusion during the period of constant rotation or during a 30-minute period following rotation. It was concluded that adaptation does not occur under these experimental conditions and that the oculogravic illusion is dependent upon a number of perceptual processes. (Authors' summary, modified)

953
Clark, B.,
and A. Graybiel
CONTRIBUTING FACTORS IN THE PERCEPTION OF THE OCULOGRAVIC ILLUSION.—Amer. Jour. Psychol., 76 (1): 18-27. March 1963.

The purpose of this investigation was to study the effect of an antecedent visual frame of reference on the perception of the horizontal when the direction and magnitude of the gravitational force acting on the body were changed. Initial static measures of the perceived horizontal were made with the experimental room stationary. Deviations of the perception of the horizontal from these static measures were determined as a function of time after exposure to a visual framework while the room was rotating to produce a change in magnitude and direction of resultant force acting on the observers. In other words, changes in the amount of the oculogravic illusion served as the criterion of change in the perception of the horizontal. The experiment consisted of two parts: observations following prolonged exposure to a visual framework and observations following varied short exposures. The results showed that the deviation of the perceived horizontal from the static line-of-subjective-horizontal increased fairly rapidly up to about 60 sec. and more slowly for an equal time thereafter. This was found to be true of both long and short exposures. No consistent, systematic differences were observed between exposure time from 1 sec. to 2 min. The results show a gradual, though not a simple, continuous change in the frame of reference from visual to gravitational cues. This is in sharp contrast with the change from a gravitational to a visual framework which occurs very quickly. (Authors' summary)

954
Clark, B.,
and A. Graybiel
PERCEPTION OF THE POSTURAL VERTICAL FOLLOWING PROLONGED BODILY TILT IN NORMALS AND SUBJECTS WITH VESTIBULAR DEFECTS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1); and National Aeronautics and Space Administration, Washington, D. C. (Order no. R-37). Report no. 81, April 10, 1963. ii+7 p.

Nine normal men and ten men with defective vestibular function were studied to determine the effects of prolonged bodily tilt on their perception of the postural vertical. The subjects were tested under two conditions of delay before setting themselves to vertical and four degrees of tilt. A 2 x 2 x 4 analysis of variance showed significantly greater average errors for the vestibular defective men, for prolonged delay in recovery to vertical, and for the larger tilts. (Authors' abstract)

955
Clark, C. C.
HUMAN CONTROL PERFORMANCE AND TOLERANCE UNDER SEVERE COMPLEX WAVEFORM VIBRATION WITH A PRELIMINARY HISTORICAL REVIEW OF FLIGHT SIMULATION. — The Martin Co., Baltimore, Md. Engineering Report no. 12406, April 1962. [37] p.

Problems of terminology of acceleration and flight simulation are reviewed, with a preliminary historical review of particularly moving base flight simulation. The capabilities and limitations of the Navy Johnsville human centrifuge and the North American Aviation (Columbus) "G-seat" for jostle simulation are presented; the latter is more rea.-istic. Potential developments of restraints, displays, and controls for use in severe jostle environments are noted. A "relative jostle biological effectiveness" concept is suggested for test as a means of comparing the biological effects of jostle environments with different frequency components. (From the author's summary) (94 references)

956
Cohen, A. B.
THE EFFECT OF CARBON DIOXIDE INHALATION ON EXPERIMENTAL SHOCK IN THE RAT.—Bull. School of Med., Univ. Maryland, 47 (3): 39-41. July 1962.

Rats in which states of shock were produced by tumbling them in a Noble-Collip apparatus, showed a statistically significant drop in mortality by 5-7% CO_2 inhalation prior to rotation. Possible interrelationships between pretraumatic administration of CO_2 and the prevention of shock are discussed. (Author's summary, modified)

957
Crampton, G. H.,
and W. J. Schwam
TURTLE VESTIBULAR RESPONSES TO ANGULAR ACCELERATION WITH COMPARATIVE DATA FROM CAT AND MAN.—Jour. Compar. and Physiol. Psychol., 55 (3): 315-321. June 1962.

Previously issued as report: Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X95-25-001). Report no. 471, April 26, 1961. ii+17 p.

The head-turning response of the turtle (*Terrapene c. carolina*) to angular acceleration was measured under conditions in which the visual cues were virtually eliminated. The turning response continued throughout an acceleration, and a subsequent deceleration served to return the head toward its normal central position. The practical stimulation values were similar to those for mammals except for a restriction of the range. No saccadic movements of the head were seen nor was habituation, a response decrement occurring in mammals when repeatedly tested, evident for the turtle. No vestibular nystagmus of the eyes could be recorded electrically in total darkness, nor was a post-rotatory ocular nystagmus found in room illumination. The comparison of turtle head-turning to slow phases of cat and human ocular nystagmus established a similarity between the two responses. The similarity suggests that turtle head-turning is a simple extended slow-phase deviation not interrupted by the fast saccadic movements characteristic of mammalian ocular nystagmus. (Authors' summary) (25 references)

958
Danileiko, V. I.
[PHYSIOLOGICAL REACTION OF THE ORGANISM OF SMALL ANIMALS TO THE PROLONGED ACTION OF TRANSVERSAL ACCELERATION] Fiziologichna reaktsiia organizmu dribnykh tvaryn na tryvalyi vplyv poperechnoho pryskorenyia. — Fiziologichnyi zhurnal (Kyiv), 8 (2): 220-230. March-April 1962. In Ukrainian, with English summary (p. 230).

A study was made of tolerance to continuous transversal acceleration in the range of 18.1-23.5 g (centrifuge radius = 0.65 m.) in small animals, namely, albino rats, Siberian marmots, albino mice, pigeons, sparrows, and a turtle. In some experiments electrocardiographic recordings were made and heart and lung preparations investigated histologically. The results show that small warmblooded animals are able to tolerate transversal acceleration of about 20 g for a considerable number of minutes. The acceleration tolerance is raised by anesthesia, hypothermia, and hibernation. (Author's summary, modified)

959
Dodge, C. H.,
and C. C. Wunder
SURVIVAL AND GROWTH OF JUVENILE TURTLES EXPOSED TO CONTINUOUS CENTRIFUGATION [Abstract]. —— Physiologist, 5 (3): 130. Aug. 1962.

With hatchling Red-Eared Turtles (Pseudemys scripta elegans), growth could be either enhanced or retarded depending upon field intensity. During 9 weeks of centrifugation at 5 g, turtles grew 112±26% more than their controls. At still higher fields, growth decreased as the field increased. However, at fields as intense as 28 g, a few turtles displayed measurable growth. Times for 50% mortality were 3, 7, and 31 days at 28, 24, and 21 g respectively. At 6, 10, and 13 g there was no significant mortality. The superior ability of turtles to survive high gravity can be attributed to their aquatic environment and the shell, which acts as a natural "anti-g suit". (Authors' abstract)

960
Dodge, C. H.,
and C. C. Wunder
GROWTH OF JUVENILE RED-EARED TURTLES AS INFLUENCED BY GRAVITATIONAL FIELD INTENSITY. —— Nature (London), 197 (4870): 922-923. March 2, 1963.

Juvenile red-eared turtles (Pseudemys scripta elegans) about 34 millimeters in length were kept in centrifugal fields of 5 to 28 g for 5 to 9 weeks. The animals were kept active during the normal time of hibernation. Changes in the carapace length were comparable to changes in body mass. The turtles kept at 5 g had grown about twice as fast in carapace length after 5 weeks as had the controls. With a further increase to 6 g and above there was a progressive decrease in growth. Shell mass at 5 g was absolutely and relatively greater in some animals than in the controls at 1 g. It is thought that possibly rotation and vibration may also be factors in accelerated growth.

961
Duane, T. D.,
D. H. Lewis, S. D. Weeks, and J. F. Toole
THE EFFECTS OF APPLIED OCULAR PRESSURE AND OF POSITIVE ACCELERATION ON PHOTIC DRIVING IN MAN. —— Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask MR005.13-6002.1, Report no. 16). Report no. NADC-MA-6214, Dec. 28, 1962. iii+9 p.

Also published in: Neurology, 13 (3): 259-262. March 1963.

Several subjects who demonstrated the phenomenon known as photic driving of the electroencephalogram were employed in experiments with the ophthalmodynamometer and with positive acceleration on the human centrifuge. In both of these forms of stress, when the intraocular pressure exceeded the retinal arteriolar diastolic pressure, a direct correlation was demonstrated to peripheral field constriction and loss of the previously apparent photic driving in the electroencephalogram. The latter did not reappear when the intraocular pressure exceeded the retinal arteriolar systolic pressure but did reappear as soon as the intraocular pressure was beneath the retinal arteriolar diastolic pressure. This suggests that photic driving is related to the rod portion of the human retina, since with retention of central vision, which is primarily a cone function, photic driving remained inhibited. (Authors' summary)

962
Evans, F. G.,
H. R. Lissner, and L. M. Patrick
ACCELERATION-INDUCED STRAINS IN THE INTACT VERTEBRAL COLUMN. —— Jour. Applied Physiol., 17 (3): 405-409. May 1962.

Results of more than 170 tests with the embalmed bodies of a 69-year-old white male and two Negro males 56 and 82 years of age which were subjected to a maximum acceleration of 20 g revealed an approximately linear relation between acceleration and strain in the sacral ala and lumbar vertebrae. This relationship was less linear for the thoracic and cervical vertebrae. The magnitude of compressive strain in the anterior aspect of the body of the third cervical vertebra (C$_3$) and the third lumbar vertebra (L$_3$) is a function of the degree of freedom of movement of the head and thorax. The strain in C$_3$ is progressively increased by increasing freedom of movement of the head and thorax but the opposite effect occurs in L$_3$. The anterior aspect of the body of C$_3$ is subjected to compressive strain in the normal position of the head but extension of the head changes the strain to tension. Seating the cadaver on a polyurethane cushion 4 in. thick increased the peak strain in the vertebral column. No vertebral fractures or dislocations demonstrable by X-rays have been produced by maximum accelerations of 20 g. Endplate fractures of 28 fresh vertebrae were produced by an average load of 672 pounds (435-900 pounds) statically applied in a materials-testing machine. (Authors' abstract)

963
Farrer, D. N.,
M. E. Grunzke, G. A. Gilbert, G. A. Barnhart, and P. D. Jacobs
CHIMPANZEE PERFORMANCE ON A CONTINUOUS AVOIDANCE TASK DURING ACCELERATION AT SUSTAINED LOW LEVELS.—Aeromedical Research Lab., Holloman Air Force Base, New Mexico (Project no. 6893, Tasks no. 689301 and 689302). Technical Documentary Report no. ARL-TDR-63-6, March 1963. vi+19 p.

Chimpanzee performance during 1 g, 2 g, and 4 g transverse and positive accelerations was evaluated with a pilot study (one subject) and a crossover design (four subjects). Each test lasted 90 minutes (30 minutes at 1 g; 30 minutes at 2 g or 4 g; 30 minutes at 1 g). Performance, heart rate, respiration rate, and body temperature were monitored. It was concluded that a performance decrement results during exposure to 4 g positive acceleration for 30 minutes. The heart rate was high throughout all tests, but it increased while the subject monitored the cue lights and decreased during rest periods. The respiration rate did not change consistently as a function of either g force or work. Body temperature consistently decreased during the tests. (Authors' abstract)

964
Finn, J. C.,
and O. D. Brown
PRELIMINARY REPORT ON PLAGIOGEOTROPISM IN XANTHIUM PENSYLVANICUM.—Proceedings of the Lunar and Planetary Exploration Colloquium, 3 (2): 147-151. May 5, 1963.

Clinostats, mounted horizontally and radially about the periphery of a 13-foot centrifuge, afford a means for determining the positioning response of petioles in Xanthium pensylvanicum and other erect-type plants when subjected to accelerations of less than one g. The degree of petiole epinasty is inversely proportional to acceleration (apex to roots). Stem growth appears slower at less than one g. Included are representative figures and one table. (Authors' abstract)

965
Frankenhaeuser, M.,
K. Sterky, and G. Jaerpe
PSYCHOPHYSIOLOGICAL RELATIONS IN HABITUATION TO GRAVITATIONAL STRESS. — Perceptual and Motor Skills, 15 (1): 63-72. Aug. 1962.

Habituation to acceleration in a human centrifuge was studied with four healthy individuals, observing changes in the subjective reactions and several physiological indices (heart rate, urinary adrenalin and noradrenalin excretion). Positive acceleration below the threshold for loss of consciousness was applied. Subjective reactions were estimated on a ratio estimation scale using as a baseline each subject's most stressful experience. The results showed that upon consecutive exposures there was a progressive decrease in adrenalin excretion and subjective emotional reaction to gravitational stress. The intensity of the subjective reactions was almost proportional to the amount of adrenalin excreted. There were no systematic changes in noradrenalin excretion or heart rate.

966
Gierke, H. E. von,
and R. R. Coermann
THE BIODYNAMICS OF HUMAN RESPONSE TO VIBRATION AND IMPACT.—Revue de médecine aéronautique (Paris), 1 (2): 201-203. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (1): 31-32. Jan. 1963.

There is a definite relationship between vibration and impact tolerance, and the mechanical models derived from steady-state vibration studies are very helpful for the interpretation and prediction of impact tolerance data. However, further refinement of these models and study of other load directions are necessary. Knowledge of the dynamic properties of the human body, of the body of various animals, and of dummies are of particular value for drawing any valid conclusions from the experiments as to their meaning with respect to human subjects. Finally, theoretical analysis of the response of the complex human system to impact loads shows clearly that a complete description of the force-time function of the impact load is necessary to define response or tolerance uniquely. Only in very limited impact duration ranges can single parameters like peak acceleration, impulse, or rate of onset be considered as quantity of primary importance for the response. (From the authors' summary)

967
Giurdzhian, A. A.,
M. A. Lomova, and L. A. Radkevich
[NON-ESTERIFIED FATTY ACIDS CONTENT IN BLOOD PLASMA OF RATS EXPOSED TO ACCELERATIONS] Soderzhanie neesterifizirovannykh zhirnykh kislot v plazme krovi u krys, podvergshikhsia deistviiu uskorenii.—Doklady akademii nauk SSSR (Moskva), 151 (4): 982-985. Aug. 1, 1963. In Russian.

Rats were exposed to accelerations of 2, 5, 10, 15, 20, 25, and 30 g for 5-minute periods. No changes in the concentration of non-esterified fatty acids in the blood were noted in animals subjected to 2 and 30 g. However, concentrations were uniformly elevated after exposure to accelerations of 5-25 g. Animals exposed daily to the stress of 1.5 to 2 g for a 2.5-month period failed to show any significant differences in non-esterified fatty acid concentration as compared with controls.

968
Goodall, M.
SYMPATHOADRENAL RESPONSE TO GRAVITATIONAL STRESS. — Jour. Clinical Investigation, 41 (2): 197-202. Feb. 1962.

Subjects were centrifuged and their urine collected before and after centrifugation and bioassayed for adrenaline and noradrenaline. Urinary output of adrenaline and noradrenaline was correlated to the g tolerance of the subject and to various g exposures. Adrenaline output increased before centrifugation as well as during and immediately after centrifugation. This increase was largely related to emotions, i.e., anxiety associated with the anticipation of being centrifuged, rather than to the physiological changes produced by centrifugation. Noradrenaline output was elevated only during centrifugation and during the period immediately following centrifugation. This increased output appeared to be dependent upon the physical stress imposed by centrifugation and had no direct relationship to the subject's g tolerance. (Author's summary, modified)

969
Gozulov, S. A.
SEVERAL PHYSIOLOGICAL REGULARITIES OBSERVED UNDER SHOCK ACCELERATION EFFECTS (CONCERNING THE THEORY OF PHYSIOLOGICAL EFFECTS OF MECHANICAL ACTION UPON THE ORGANISM).—Revue de médecine aéronautique (Paris), 1 (3): 19-20. March-April 1962. In English.

During the mastering of sonic and cosmic velocities numerous opportunities arise from the unfavorable action of shock accelerations [impact] upon the organism. These effects are most probable during the breakdown of ground and air-transport and during the rescue of flight crews. In all cases, safety depends on a number of conditions in which the shock action upon the organism takes place and upon the stability of the organism to mechanical energy. Several stages or periods of after-effects are observed in the dynamics of functional changes following the impact of shock stress: (1) the stage of primary reflex disturbances caused by the immediate action of mechanical forces on the tissues and organs (delay or cessation in respiration, bradycardia or deeper rhythm disorders, drop in arterial pressure, cessation of motor reactions, etc.), and (2) the stage of reflex responses directed towards the normalization of the disorganized functions. The mechanical action of a certain force upon the organism is associated with the number of functional deviations which repeat in keeping with their regularities and may be combined and represented as a physiological response to a total action of a mechanical stimulus. The psychological response to impact is also significant in these functional changes.

970
Gozulov, S. A.
[SOME PHYSIOLOGICAL PRINCIPLES DERIVED FROM THE EFFECT OF IMPACT ACCELERATIONS] Nekotorye fiziologicheskie zakonomernosti, nabliudaemye pri vozdeistvii udarnykh uskorenii.—Problemy kosmicheskoi biologii (Moskva, 2: 226-230. 1962. In Russian, with English summary (p. 229-30).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 240-243. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The action of mechanical energy on the body in the form of impact acceleration is accompanied by certain physiological changes. The thresholds of injurious effects vary with the conditions at the time of impact, protective measures, and the physiological condition of the organism; all of these establish the limits of tolerance. Prior to the impact there is a preliminary compensatory intensification of physiological functions through conditioned reflexes which represents a protective biological mechanism against possible injurious effects of overstimulation. The aftereffects of impact are characterized by an absolute or relative weakening of all functions. The first stage consists of depression of respiration, disturbances of the cardiac rhythm, a drop in blood pressure, inhibition of motor reactions, and lowered muscle tone. These changes are the direct effect of acceleration through overstimulation of the major afferent systems in the organism, which eventually leads to widespread inhibition of functions. The subsequent stages are either an expression of self-regulatory mechanisms toward normalization of the functions or they are characterized by exhaustion of the neuroregulatory mechanisms.

971
Grandpierre, [R.],
Angiboust, and Chatelier
[OUTLINE OF THE FIRST PHYSIOLOGICAL RESULTS FROM THE FRENCH BIOLOGICAL ROCKET EXPERIMENT] Exposé des premiers résultats physiologiques de l'expérience biologique française en fusée. — Revue de médecine aéronautique (Paris), 1 (4): 69. July-Aug. 1962. In French.

A rat exposed to complex accelerations in the head of a Veronique rocket launched into space revealed an intense cortical activity which persisted throughout the flight. In contrast to this cortical activity, the reticular rhythm remained stable until the hundredth second of the ballistic period when the reticular tracing flattened out, decreased progressively, and exhibited slow waves. Cardiac and respiratory rhythms also decreased.

972
Grandpierre, R.,
R. Angiboust, G. Chatelier, J. B. Coin, J. Ginet, and J. Rozier
[ROLE OF AFFERENT IMPULSES FROM THE LABYRINTH IN VEGETATIVE REACTIONS OBSERVED IN THE RAT DURING CENTRIFUGATION] Rôle des afférences labyrinthiques dans les réactions végétatives observées chez le rat au cours de centrifugation.—Revue de médecine aéronautique (Paris), 2 (8): 430-436. Aug.-Sept. 1963. In French.

In an attempt to determine the labyrinthine effects during acceleration stress, rats from which the labyrinths had been surgically removed, anesthetized rats (1% Nesdonal), and normal rats were centrifuged at 8 g for 10 seconds while suspended upright or head down in their containers. Cardiac and respiratory frequencies were monitored. In the normal rat, vegetative reactions at the start and end of centrifugation were manifested in bradycardia and tachypnea. Bradycardia appeared to result from liquid displacement in the semicircular canals plus an unspecific emotional stress. Tachypnea appeared to be a nonspecific alert reaction since it disappeared in anesthetized rats but persisted in rats without labyrinths.

973
Guedry, F. E.,
and A. Graybiel
COMPENSATORY NYSTAGMUS CONDITIONED DURING ADAPTATION TO LIVING IN A ROTATING ROOM. — Jour. Applied Physiol., 17 (3): 398-404. May 1962.

Seven men were rotated at 5.4 r.p.m./min. in a room for 64 hours. Controlled tests before and during this interval demonstrated that disorientation and nystagmus attributable to Coriolis acceleration effects diminished markedly. A compensatory nystagmus, induced by head or whole-body movements, was recorded more than 1 hour after the rotation had ceased. Factors of possible significance in conditioning the compensatory nystagmus are: (1) otolith and proprioceptor sensory influx prior to and during discordant canal input; (2) a consistent sensory influx for each stimulus-producing movement; (3) intention in stimulus-producing movements; and (4) visual inhibition. Contributions of compensatory and arousal factors to vestibular suppression are considered in relation to practical problems of transfer of habituation from one acceleration environment to another. (Authors' abstract)

974
Guedry, F. E.,
A. Graybiel, and W. E. Collins
REDUCTION OF NYSTAGMUS AND DISORIENTATION IN HUMAN SUBJECTS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1), and National Aeronautics and Space Administration, Washington,

D. C. (NASA Order no. R-47). Report no. 69, June 19, 1962. ii+8 p.

Nystagmus, disorientation, and nausea were reduced in subjects living and moving about for several days in a slowly rotating room. The reduced nystagmus was not reinstated by assigning "arousal-tasks" which are ordinarily effective in this respect. After rotation was stopped residual effects were noted for several hours. These included compensatory nystagmus, compensatory illusory reactions, and some motion sickness. Other subjects were exposed to similar circumstances for shorter periods wherein only restricted head movements in a particular plane were permitted. Nystagmus, illusory phenomena, and nausea were reduced by this procedure. However, the habituation did not transfer to forms of vestibular stimulation including head movements in an "unpracticed quadrant" which produce reactions similar in direction and plane to those repeatedly experienced during the habituation period. Residual effects from this shorter more restricted exposure were slight. (Authors' abstract)

975
Guedry, F. E.,
R. S. Kennedy, C. S. Harris, and A. Graybiel
HUMAN PERFORMANCE DURING TWO WEEKS IN A ROOM ROTATING AT THREE RPM.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1), and National Aeronautics and Space Administration, Washington, D. C. (NASA Order no. R-47). Report no. 74, Aug. 28, 1962. ii+26 p.

Four men were tested before, during , and after being rotated at 3 r.p.m. for two weeks in the Pensacola Slow Rotation Room. The men also lived in the room preceding the commencement of the rotation. Tests of intellectual and physiological function were included. The principal finding was that no serious psychological deficit was detected during two weeks of rotation or during the subsequent readaptation to normal environment. The only test showing pronounced deterioration of performance at the beginning of rotation and upon returning to normal environment was the Graybiel-Fregly Posture Test. This means that any task requiring ordinarily difficult locomotion would be disturbed at these critical intervals. Ordinary walking with adequate visual reference was not so obviously affected. Results are discussed in relation to problems of rotating space stations, the vestibular system, and experiments involving optimally distorted visual information. (Authors' abstract) (30 references)

976
Guignard, J. C.
THE PHYSIOLOGICAL EFFECTS OF TRANSIENT MECHANICAL FORCES: A REVIEW OF THEIR RELEVANCE TO ASTRONAUTICS.—In: Space research and technology, p. 12-14. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

Mechanical stresses which may occur in space flight and the physiological responses to these stresses are reviewed. Noise and vibration levels are high in large rocket vehicles under power. During re-entry at orbital velocities buffeting of a space vehicle would be poorly damped at the fringe of the atmosphere and might induce vibrations and oscillatory flight patterns of sufficient intensity to prohibit the crew from controlling the descent. In space there would be no damping and any vibration must be absorbed by the vehicle and its occupants. Structure-borne oscillations at frequencies below 100 cycles per second are a potential cause of discomfort, fatigue and imparied performance. Low-frequency shaking, below 10 cycles per second, is a serious nuisance and is difficult to isolate. It is considered doubtful whether man could undertake operations in individual spacesuits outside the main vehicle when in orbit. The suit would have to be a massive device incorporating gyroscopic stabilization to prevent undamped spin or tumble, and whole-body harness and anti-shock packaging to avoid impact injuries in a collision. (Author's abstract)

977
Hack, W. F.
HYGE SHOCK TEST FACILITY AT 6571ST AEROMEDICAL RESEARCH LABORATORY. — Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850, Task no. 785001). Technical Documentary Report no. ARL-TDR-62-22, Sept. 1962. v+23 p.

The HYGE Shock Tester is a unit produced by the Consolidated Electro-Dynamics Corporation as a test device to generate and accurately reproduce high-acceleration g forces for short time periods. The installation of the device at the 6571st Aeromedical Research Laboratory, its electronic support equipment, and its operational procedures are described. Ease of operation and maintenance of this unit coupled with its versatility makes it useful as a research tool in physical and biophysical testing. (Author's abstract, in part)

978
Howard, I. P.,
and W. P. Templeton
A CRITICAL NOTE ON THE USE OF THE HUMAN CENTRIFUGE.—Amer. Jour. Psychol., 76 (1): 150-152. March 1963.

An argument is presented against the use of human centrifuge in the study of the effects of displacement of the direction of force acting on the body on the perception of the vertical. Since gravitational and centrifugal forces are physically indistinguishable, tilting in a chair is an equally satisfactory method of introducing a change in the direction of the force on the body. Vibration of the centrifuge may introduce undesirable side effects.

979
Howard, P.
THE ORIGIN OF BLACK-OUT. — In: Visual problems in aviation medicine, p. 71-77. Ed. by A. Mercier. Oxford: Pergamon Press, 1962.

Subjects were exposed for at least 30 seconds to positive acceleration applied at a rate of 0.1 g per second. Subsequent runs were made at 0.4-0.8 g greater than the control value. When peak acceleration was reached, light from a bright source was presented to the eyes. The normal black-out threshold of the subject was determined using the standard peripheral and central light technique. Subjects undergoing accelerations well above their black-out threshold were able to perceive light if the stimulus was sufficiently strong. The apparent brightness of successive stimuli decreased, and vision was finally lost. The time-course of the phenomena, and the conditions under which they occur, point to a reserve of function in the anemic retina. The decrement and final loss of vision was due to a failure of transmission of nervous impulses. The direct pupillary reflex was found to persist after the extinction of vision. No detectable difference was found between pressure blindness and the black-out of acceleration. The site of the disturbance of function was within the retina but beyond the point where visual and reflex pathways diverged. (Author's summary and conclusions, modified)

980
Howard, P.
ACCELERATION RESEARCH AND AEROSPACE MEDICINE.—Med. Jour. Australia (Sidney), 1963 (12): 425-427. March 23, 1963.

With the coming of World War II, methods for increasing human tolerance to centrifugal accelerations in flight which gave rise to blackout and unconsciousness were investigated on centrifuges in the United States. These were not the first centrifuges to be built. One of the earliest was constructed for treatment of the insane in Berlin in 1820. Research with the centrifuge at Mayo Clinic provided evidence that loss of vision was due to hypotension at the level of the eye. From this point on the centrifuge served mainly as an indicator of the effectiveness of various countermeasures which were devised to combat blackout. Acceration research became important when manned space flight became feasible. The original work on tolerance in 1940 showed that the only reasonable way of withstanding the high forces expected during launching was to apply them through the short axis of the body in the fore or aft direction. Acceleration research illustrated the importance of the laboratory in aviation and space medicine.

981
Hyde, A. S.
THE EFFECT OF BACK ANGLE, MOLDED SUPPORTS, AND STAGED EVISCERATION UPON INTRAPULMONARY PRESSURES IN DOGS AND A MONKEY DURING FORWARD ($+G_x$) ACCELERATION. — Aerospace Medical Division. Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722202). Technical Documentary Report no. AMRL-TDR-62-106, Sept. 1962. iii+12 p.

Static intrapulmonary pressures were recorded at positive accelerations from 2 to 16 g in live (curarized) and dead dogs and a monkey during forward inclinations of 5° increments from 0° to 45°. The pressures primarily reflect shifts of the diaphragm due to acceleratory forces. The influence of staged evisceration and staged molded support systems were also studied. Essentially null displacement occurred between 10° and 15° of forward inclination. Above and below these angles, diaphragmatic displacement was proportional to acceleration and relatively uninfluenced by molded support systems. Staged evisceration clearly established the literal dependency of diaphragmatic movement upon the presence of the liver. (Author's abstract) (25 references)

982
Hyde, A. S.,
N. S. Cherniack, E. F. Lindberg, and D. Whately
SOME CARDIORESPIRATORY RESPONSES OF FLYING AND NON-FLYING PERSONNEL TO DIFFERENT VECTORS OF ACCELERATION WITH CORRELATION OF THESE RESPONSES TO OTHER VARIABLES.—Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722202). Technical Documentary Report no. AMRL-TDR-62-151, Dec. 1962. iii+9 p.

The cardiovascular and respiratory responses of test pilots are compared with the AMRL centrifuge panel members during headward ($+G_z$) and forward ($+G_x$) accelerations. Vital capacity decreased in all subjects with increasing forward acceleration. No significant difference existed between the cardiorespiratory performance of test pilots and that of the nonrated personnel that constituted the Aerospace Medical Research Laboratories centrifuge panel. No correlation was noted between blackout and pulse rate, but correlation did exist between resting control and $+5G_z$ pulse rates. An extensive number of anthropometric measurements, indices of physical fitness, and measurements made during other stress did not correlate with tolerance to headward ($+G_z$) acceleration or with respiratory performance during $+G_z$ and $+G_x$ acceleration. (Authors' abstract)

983
Isakov, P. K.,
and R. A. Stasevich
[SPEED, ACCELERATION, WEIGHTLESSNESS] Skorosti, uskoreniia, nevesomost'.—147 p. Moskva, Voennoe Izdatel'stvo Ministerstva Oborony SSSR, 1962. In Russian.

This is a popular exposition of some physical and physiological problems encountered during atmospheric and space flight. It includes the following topics of interest to aerospace medicine: effects of motion on organisms; linear, centripetal, angular, and rotational accelerations; physiological responses to alterations of motion; factors determining aftereffects of acceleration and methods to increase acceleration tolerance; physical factors and artificial induction of weightlessness and their effects on organisms; and accelerations and weightlessness during space flights.

984
Izosimov, G. V.,
and A. N. Razumeev
[THE EFFECTS OF DIFFERENT DEGREES OF LONG-LASTING TRANSVERSE ACCELERATIONS ON THE BIOELECTRICAL REACTIONS OF THE HUMAN CEREBRAL CORTEX] Vliianie razlichnykh po velichine dlitel'nykh poperechnykh peregruzok na bioelektricheskie reaktsii kory golovnogo mozga.—Problemy kosmicheskoi biologii (Moskva), 2: 247-254. 1962. In Russian, with English summary (p. 254).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 259-265. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce, OTS: 63-21437)

A study was made on the effects of prolonged transversal acceleration of different intensity on the heart rate, respiration, and the bioelectric activity of the cerebral cortex of rabbits. During and after exposure changes on the electroencephalogram followed a phasic course. The reticular formation apparently plays an important role in the mechanism of the phasic changes. Administration of thorazine blocks the afferent impulses at the level of the reticular formation and prevents the phasic course of the bioelectrical activity of the brain in response to acceleration. The time of the onset of "initial inhibition" depends on the degree of acceleration and may be graphically expressed in the form of a hyperbola.

985
Izosimov, G. V.,
and A. N. Razumeev
[STUDY OF CHANGES OF THE BIOELECTRICAL ACTIVITY OF THE CEREBRAL CORTEX DURING THE ACTION OF PROLONGED TRANSVERSE ACCELERATIONS] Izuchenie izmenenii bioelektricheskoi aktivnosti kory golovnogo mozga pri vozdeistvii na organizm dlitel'nykh poperechnykh peregruzok.—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1962 (4): 621-626. July-Aug. 1962. In Russian, with English summary (p. 626).

Studies of the effects of transversal accelerations (2-14 g for 10-4 minutes) were made on 50 rabbits. Preliminary investigations indicated that the rabbits were of four types in respect to the nature of the electroencephalogram: Type I was characterized by the predominance of slow waves (1-3 c.p.s.), Type II by spindle-shaped discharges of 12-14 c.p.s., Type III by segments with waves of 5-6 c.p.s. and also very slow waves, while Type IV showed a combination of the above indices. Accelerations produced phasic electroencephalographic responses in all animals, which also were of four categories corresponding to the preacceleration type of the electroencephalogram. Thus the Type I showed an initial decrease of potentials (to 80-100 microvolts) and of slow synchronous waves, which became more pronounced with continuous acceleration; Type II had decreased wave amplitudes and increased rapid rhythms during the initial phase, while during the second phase the spindle-shaped discharges were quite pronounced; Type III responded to acceleration by a predominance of the 5-6 c.p.s. rhythm, with a subsequent amplitude increase to 250-300 microvolts; and Type IV had an initial predominance of 5-6 c.p.s. waves which were later replaced by slow waves (1-3 c.p.s.).

986
Jones, G. Melvill
OCULOMOTOR RESPONSES TO SIMULTANEOUS ROTATIONAL STIMULI ABOUT TWO ORTHOGONAL AXES [Abstract].—International Congress of Physiological Sciences, 22 (Leiden, 1962), Proceedings, vol. 2, no. 1017. Amsterdam [1962?].

Five subjects were rotated at approximately 30°/second^2 to a steady angular velocity of 120° per second maintained for 3 minutes and followed by a stopping deceleration lasting 4 seconds. Simultaneous stimuli were achieved about yaw (longitudinal) and roll (saggital) axes of the head by fixing it in a position of 45° backward tilt. With the right eye looking "straight ahead," a cine technique was employed for simultaneous recording of the resulting left eye movement about yaw and roll axes. Ocular compensation about the yawing axis ("horizontal" nystagmus) was good during the acceleration, declined somewhat during the steady rotation, but tended to be restored during the final deceleration despite reversed vestibular influence. In contrast, only roughly 50% compensation was achieved about the rolling axis during acceleration and this declined to zero during the steady rotation. On deceleration, rolling nystagmus was reversed, but with smaller response than during acceleration. It is concluded that in the yawing plane, optokinetic influence was highly effective, tending to dominate vestibular influence when the latter was inappropriate; whereas in the rolling plane the vestibular influence dominated throughout, the optokinetic influence being relatively weak but not insignificant. (Author's abstract)

987
Kas'ian, I. I.
[SOME PHYSIOLOGICAL REACTIONS OF ANIMALS DURING FLIGHTS IN CAPSULES OF BALLISTIC ROCKETS TO ALTITUDES OF UP TO 450-473 KM.] Nekotorye fiziologicheskie reaktsii zhivotnykh pri poletakh v biokabinakh ballisticheskikh raket do vysoty 450-473 km. — Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1963 (2): 201-213. March-April 1963. In Russian, with English summary (p. 213).

Six dogs were exposed to transverse accelerations during flights in ballistic rockets and, as a rule, showed distinct changes in their respiratory and circulatory systems. During the active flight phase, the maximal blood pressure increased by 98-100 mm. Hg, while the minimal pressure did not show any substantial changes. The pulse rate during the same period increased by 45-120 c.p.m. and the respiration rate by 45-75 c.p.m. A drastic increase was noted in the voltage of the $P_2R_2T_2$ spikes, while the R-R, Q-T, QRS time intervals were shortened. These changes are not regarded as pathological but seem to indicate that the organism possesses a considerable compensatory adaptation potential. During weightlessness, the test animals nearly attained normal levels of cardio-vascular and respiratory functions. After recovery, increases in leucocyte count and decreases in lymphocyte and monocyte counts were observed in the peripheral blood. A four-year follow-up study of dogs did not reveal any adverse effects subsequent to the experiments. The data discussed in this paper were utilized for the planning and execution of biological experiments in orbital flights of Vostok type sputniks.

988
Kas'ian, I. I.
[SOME PHYSIOLOGICAL RESPONSES OF MAN TO ALTERNATING ACCELERATIONS AND BRIEF PERIODS OF WEIGHTLESSNESS] Nekotorye fiziologicheskie reaktsii cheloveka v usloviiakh peremezhaiushchegosia vliianiia peregruzok i kratkovremennoi nevesomosti.—Izvestiia Akademii

nauk SSSR, Seriia biologicheskaia (Moskva), 1962 (6): 896-908. Nov.-Dec. 1962. In Russian, with English summary (p. 908).

Fifty-five test subjects were exposed to parabolic flights for periods of 20-45 sec., alternating with conditions of positive acceleration. This resulted in an increase in respiration and pulse rates. The latter fluctuated between 66-96 c.p.m. under control conditions, increased 15-30 c.p.m. during horizontal flight, and further increased 10-54 c.p.m. during acceleration. During weightlessness, the pulse rates were variable as compared to controls. The respiration rates were higher than normal, throughout the duration of flights. The electrocardiograms indicated that at 3.5 g, P_2 values increased, while R_2 and T_2 values were lowered. The P-Q, Q-T, R-R, and T-P intervals were shortened in most cases, while no changes were noted in the S-T segments. In general, the cardiac response consisted in reduction of contraction rates and subsequent rapid normalization of electrocardiograms. It is concluded that a brief exposure to weightlessness and acceleration has no irreversible pathological effects.

989
Kiselev, A. A.
[SOME CHARACTERISTICS OF THE HEMODYNAMICS AND GAS EXCHANGE IN THE PULMONARY CIRCULATION DURING TRANSVERSE CHEST-BACK ACCELERATIONS] Nekotorye osobennosti gemodinamiki i gazoobmena v malom kruge krovoobrashcheniia pri poperechnykh uskoreniiakh grud'-spina.—Problemy kosmicheskoi biologii (Moskva), 2: 231-237. 1962. In Russian, with English summary (p. 237).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 244-250. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Alterations in the hemodynamics and the gas exchange in the pulmonary circulation were studied in dogs subjected to transverse accelerations in the ventral-dorsal direction. In the first minute of exposure to accelerations of 3, 6, or 9 g the blood oxygenation level is maintained adequately at the expense of compensatory mechanisms in the pulmonary vessels. One of these is the progressive deposition of blood in the pulmonary arterial system, which is associated with inequality of the systolic volumes of the right and left ventricles. In spite of the compensatory mechanisms with continued acceleration the oxygenation level sinks progressively as a function of the magnitude and duration of acceleration.

990
Kotovskaia, A. R.,
and E. M. Iuganov
[THE EFFECT UPON ANIMALS OF PROLONGED TRANSVERSE ACCELERATIONS] Vliianie dlitel'nykh poperechnykh uskorenii na organizm zhivotnykh.—Problemy kosmicheskoi biologii (Moskva), 1: 384-391. 1962. In Russian, with English summary (p. 39).

Dogs exposed for 6 min. to transverse accelerations of 2-10 g showed pronounced changes in their cardiovascular and respiratory systems. The maximal arterial pressure was, as a rule, increased by 50-80 mm. Hg. The heart rate increased about 1.5-2 times, and the respiratory rate 1.5-3 times. These indices returned to normal 5-10 min. after termination of the tests. Subsequent observations failed to detect any adverse effects sustained by the test animals as a result of acceleration experiments.

991
Kotovskaia, A. R.,
S. I. Lobashkov, S. F. Simpura, P. M. Suvorov, and G. F. Khlebnikov
[THE EFFECT OF LONG-LASTING TRANSVERSE ACCELERATIONS ON THE HUMAN BODY] Vliianie dlitel'nykh poperechnykh uskorenii na organizm cheloveka.—Problemy kosmicheskoi biologii (Moskva), 2: 238-246. 1962. In Russian, with English summary (p. 245-6).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 251-258. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The effects of transverse accelerations ranging from 7 to 12 g was investigated with a selected group of healthy men. The subjects tolerated accelerations of 7 g for three minutes and 12 g for 30 seconds. Acceleration tolerance was limited by visual disturbances ("greyout" or "blackout"), respiratory difficulty, retro-sternal and epigastric pains, and multiple cutaneous hemorrhages. In most cases changes in the physiological indices remained within the permissible range. Their progression was determined by the number of g's and the duration of acceleration. High-amplitude slow waves became the basic rhythm on the electroencephalogram slightly prior to the "greyout". After the onset of visual disorders cerebral electrical activity was characterized by a marked depression. The latency of the motor reaction to light signals was increased to 0.8-0.9 second depending on the duration and the degree of acceleration. In the majority of subjects visual acuity dropped by 20-30% from the initial level. The optimum position of the human body for transverse acceleration is the position when the back of the chair is tilted forward 10° from the horizontal line. The results of this research were used in the development of a special acceleration training program.

992
Kovalenko, E. A.,
V. L. Popkov, and I. N. Cherniakov
[INTRAVITAL STUDY OF THE OXYGEN TENSION IN THE BRAIN TISSUES DURING PROLONGED ACCELERATIONS] Prizhiznennoe izuchenie napriazheniia kisloroda v tkaniakh golovnogo mozga pri dlitel'nykh uskoreniiakh. — Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 55 (1): 43-48. Jan. 1963. In Russian, with English summary (p. 48).

Dogs were exposed to prolonged accelerations on a centrifuge, and the oxygen tension in the brain tissues was measured by the polarographic method. The oxygen tension was dependent on the magnitude, direction, and duration of the acceleration.

During positive acceleration of 1-12 g for one minute, the tension dropped to 92-70% of the initial level; during transverse accelerations it fell to 92-88%; and during negative accelerations (2-8 g) to 95-84%. These reactions were somewhat influenced by the position of the animal's head in respect to the longitudinal axis of the body.

993
Kovalenko, E. A.,
V. L. Popkov, and I. N. Cherniakov
[CEREBRAL HYPOXIA DURING ACCELERATIONS IN THE CRANIO-PELVIC DIRECTION] O gipoksii mozga pri peregruzkakh v napravlenii golova-taz.—Fiziologicheskii zhurnal SSSR (Moskva), 49 (6): 719-724. June 1963. In Russian.

The oxygen tension (pO_2) was determined in the cortical motor area in the hypothalamus of dogs exposed to positive accelerations of 2 to 12 g. During the initial period of the centrifuge rotation (1 min.), accelerations of 2-4 g produced only a very slight increase in pO_2 which was followed by a reduction to 97.6-93% of the initial level; the pO_2 of anesthetized animals exposed to analogous conditions decreased without prior increase. During accelerations of 6-8 g the initial elevation in pO_2 was rapidly followed by an average reduction to 81-79% of the initial value, while during 10 to 12 g the pO_2 decreased to 76-67% of the base level.

994
Kydd, G. H.,
R. L. Fenichel, and R. J. Crosbie
OBSERVATIONS ON THE RELATIONSHIPS BETWEEN HUMAN ACCELERATION END POINTS AND THE CENTRIFUGE ACCELERATION PATTERN. — Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask MR005.13-0002.9, Report no. 3). Report no. NADC-MA-6146, Feb. 6, 1962. iii+14 p.

Nine human subjects were centrifuged on the 50-foot centrifuge according to a (positive) acceleration pattern similar to one used previously with monkeys. A total of 79 runs was made which yielded 14 end points for peripheral light loss and unconsciousness. Analysis of the records showed that only one of the end points occurred later than 15 seconds and a cinematographic record made during the runs showed that the subjects strained hardest during the initial period of the run whether or not an end point was reached. Accordingly, the hypothesis is advanced that the occurrence of an end point is dependent upon the time derivative of the onset acceleration for g forces that rise to a maximum in approximately 6 seconds and less. Since the time course of the fall in blood pressure can also be measured, a more rigorous treatment of the effects of positive acceleration is thus made possible. (Authors' summary)

995
Lalli, G.
[ON THE EFFECT OF HIGH POSITIVE ACCELERATIONS ON SOME SERUM ENZYME ACTIVITIES IN THE RAT] Sull'influenza esercitata da notevoli accelerazioni positive su alcune attività enzimatiche sieriche nel ratto. — Rivista di medicina aeronautica e spaziale (Roma), 25 (2): 234-242. April-June 1962. In Italian, with English summary (p. 240).

The following serum enzymes were determined in rats surviving twenty-four hours of exposure to positive accelerations of high intensity, long duration, and capable of producing instantaneous death (mortality rate as high as 30%): glutamic oxalacetic and glutamic pyruvic transaminase; aldolase; lactic, malic, sorbitol, and isocitric dehydrogenase; acid and alkaline phosphotase; and ceruloplasmin. The most significant increases, as compared with control animals, were found in transaminases, especially glutamic oxalacetic transaminase, and in aldolase. These changes were inconsistent.

996
Lalli, G.,
and G. Paolucci
[BEHAVIOR OF SOME SERUM ENZYMES IN THE RAT IN RELATION TO ANATOMOPATHOLOGICAL LESIONS INDUCED BY TRANSVERSE ACCELERATIONS OF GREAT INTENSITY AND SHORT DURATION] Comportamento di alcuni enzimi sierici nel ratto in rapporto alle lesioni anatomopatologiche provocate da accelerazioni transversali di notevole entità e di brevissima durata.—Rivista di medicina aeronautica e spaziale (Roma), 26 (1): 26-57. Jan.-March 1963. In Italian, with English summary (p. 54).

Rats were exposed to intense transverse accelerations (100-400 g) for short periods (only a few thousandths of a second) and sacrificed at various intervals (12, 24, 48, 96 hours) after impact in order to determine serum enzyme activity. Sorbitol dehydrogenase and glutamic pyruvic transaminase showed remarkable increase (10 times control values or more). Glutamic oxalacetic transaminase and aldolase also increased. On the contrary, lactic and malic dehydrogenase and acid and alkaline phosphatase revealed insignificant or inconsistent changes. Serum enzyme changes were observed 12 hours after impact, and were further enhanced after 24 hours, becoming reduced at 48 and at 96 hours. These changes were related to the degree of acceleration: moderate changes occurred at 100 and 200 g, increasing at 300 and higher g. Macroscopic anatomopathological lesions in head, thorax, and abdomen, and histopathological lesions in the heart, blood vessels, lungs, liver, spleen, kidneys, and adrenal glands are described and correlated with the enzymatic changes. (37 references)

997
Lalli, G.,
and G. Paolucci
[CHANGES IN SOME ENZYMATIC ACTIVITIES BROUGHT ABOUT BY ANATOMO-PATHOLOGICAL INJURY IN THE RAT SUBJECTED TO DECELERATIONS OF CONSIDERABLE INTENSITY AND SHORT DURATION. II.] Comportamento di alcune attività enzymatiche valutate in funzione del danno anatomo-patologico nel ratto sottoposto a decelerazioni di notevole entità e di breve durata. II. — Rivista di medicina aeronautica e spaziale (Roma), 26 (3): 410-427. July-Sept. 1963. In Italian, with English summary (p. 425).

Rats were subjected to transverse impact decelerations of 300-850 g for 2-3 thousands of a second. Mortality depended to some extent on the orientation of the animals (prone or supine) and was usually the result of injury to the larger blood vessels. Other organs frequently affected were the liver, lungs, spleen, and kidneys, less frequently the heart, digestive tract, and brain. In surviving animals serum enzyme activity (glutamic-oxalacetic and pyruvic transaminases, malic, lactic, and sorbitol isocitric dehydrogenases) increased, reaching a peak 14-15 hours after the impact; the highly increased values indicated severe hepatic injury.

998
Lansberg, M. P.
THE PHYSIOLOGIC ACCELEROMETERS.—Aeromedica acta (Soesterberg, The Netherlands), 8: 37-43. 1961-1962. In English.

The creation of artificial gravity by rotating the space ship around its center of gravity and thus having the centrifugal weight substitute for gravity is expected to give rise to a number of physiological disturbances. Recent experiments with a slow rotating room indicate that these disturbances may exceed the physiological tolerance limits. It seems that the primary origin of the difficulty lies in the conflict of information arriving from the otoliths, semicircular canals, and visual orientation. Therefore, the author suggests adaptation of the astronaut to a weightless environment by special training emphasizing the reliance upon visual cues and familiarity with "unnatural" situations. Similarly the design of the cabin should favor orientation based on predominantly visual cues.

999
Lindberg, E. F.,
and E. H. Wood
ACCELERATION.—In: Physiology of man in space, p. 63-111. Ed. by J. H. U. Brown. New York and London: Academic Press, 1963.

Research data on headward, footward, transverse, and angular acceleration are summarized. Man's ability to withstand acceleration depends on the magnitude, duration, and rate of onset of acceleration, the subject's position, and his support and restraint system. During headward [positive] acceleration, the subject's tolerance may be improved within limits by restricting the duration of acceleration to less than 2 to 3 seconds, by shortening the vertical hydrostatic distances over which blood must travel, and by raising arterial pressure at heart level to ensure adequate flow to the head. Little progress has been made to improve man's tolerance to footward [negative] acceleration or his much higher inherent tolerance to transverse acceleration. (Authors' summary, modified) (28 references)

1000
Lomonaco, T.
[EFFECTS OF CHANGE FROM ACCELERATIONS OF 2-3 G TO SUBGRAVITY ON SOME BODY FUNCTIONS AND ESPECIALLY ON THAT OF EQUILIBRIUM] Effetti del passaggio da accelerazioni di 2-3 g a subgravità su alcune funzioni corporee e specialmente su quella dell'equilibrio.—Missili (Roma), 4 (5): 9-18. Oct. 1962. In Italian, with English summary (p. 18).

A review is presented of various experiments dealing with the physiopathological responses of man exposed to accelerations and weightlessness, with reference to the apparatus controlling the static and dynamic equilibrium of the body. Using the subgravity tower, which is described and illustrated, studies were made of the effects of changing from accelerative to subgravitational and zerogravitational conditions on the human body similar to those which occur in orbital and suborbital launchings. Accelerations and weightlessness caused impairment of the utricle-sacculus system and the semicircular canals. Diaphragmatic displacement also occurred, indicating the probable displacement of intra-abdominal and intra-thoracic organs under these conditions. During floating caused by weightlessness several kinesthetic pheonomena were registered in the subjects. Also mentioned is an experiment with pigeons subjected to subgravity in which motor coordination was affected.

1001
Loubière, R.,
A. Pfister, G. Cheymol, and A. Rambourg
[ACCELERATION AND THE ADRENALS] Accélérations et surrénales.—Revue de médecine aéronautique (Paris), 2 (8): 414-419. Aug.-Sept. 1963. In French.

Anatomical and histological effects were determined on rat adrenals after 15 g centrifugal acceleration for 15 to 20 minutes. The adrenals were dissected from 40 rats (1) which died during centrifugation, (2) from survivors immediately after centrifugation, and (3) 2 weeks later. Anatomically, glands of animals which had died during treatment were purple and congested with blood, while there were no comparable abnormalities in the survivors. Sections of adrenal glands and sympathetic nervous system were observed microscopically. Adrenal cells from animals from the first group showed degenerative vacuoles in the adrenal cortical cells and vacuolar lesions in the sympathetic cells. Animals sacrificed immediately after centrifugation (group 2) showed similar but less extensive cell vacuolization. Two weeks after centrifugation, the lesions had almost disappeared. It is hypothesized that the lesions are a result of anoxia from cellular hyperfunction.

1002
Marukhanian, E. V.
ECG CHANGES AND CENTRAL NERVOUS SYSTEM DISTURBANCES PRODUCED BY ACCELERATION. —Sechenov Physiol. Jour. USSR (Pergamon Press, New York). 47 (7): 921-931. Jan. 1962.

English translation of: Izmeneniia v elektrokardiogramme i narushenie sostoianiia tsentral'noi nervnoi sistemy pod vliianiem uskoreniia.—Fiziologicheskii zhurnal SSSR (Moskva), 47 (7): 843-851. July 1961. In Russian.

Various electrocardiographic changes indicative of moderate deflection of the electrical axis of the heart to the right and of the primary effect of acceleration on the right heart were seen when subjects were exposed to the action of centrifugal forces in the head-to-foot direction. When there was profound functional disturbance of the central nervous system, the subjects' ECGs exhibited moderate displacement of the ST interval from the isoelectric line and reduction in the size of the T wave or a negative T wave. The most pronounced displacement of the ST interval and most pronounced change in the T wave were 10-20 sec. before the manifestations of disturbed cerebral circulation. Slight displacement of the ST interval and slight change in the T wave in subjects undergoing acceleration gave warning of the possible development of profound functional disturbances of the CNS on further increase or prolongation of the acceleration. Weakened cardiac activity as a result of primary changes in the cardiac muscle produced by hemodynamic disturbances was apparently the cause of the functional disturbance in the CNS in many cases. (Author's conclusions)

1003
Marukhanian, E. V.
[THE ELECTROCARDIOGRAPHIC SHIFTS DUE TO TRANSVERSE ACCELERATIONS] Elektrokardiograficheskie sdvigi pri deistvii poperechnykh uskorenii.—Fiziologicheskii zhurnal SSSR (Moskva), 48 (6): 700-705. 1962. In Russian.

Eight males were subjected to transverse accelerations of 8 g on a centrifuge. The electrocardiograms were taken with two standard leads, two chest leads, and sometimes unipolar leads of a left leg or chest. Recordings were made prior to and during the tests. Arterial pressure and respiration were also measured. The R wave of the electrocardiogram showed an increase in the third standard lead and in the unipolar lead of the left leg. The electrical axis of the heart shifted to the right. The R and T waves showed a low voltage in the chest leads and the S and Q waves were increased. A rise in pressure in the pulmonary artery accompanied by a distention of the right atrium was probably due to peculiarities of pressure on the viscera and a shift in the position of the heart.

1004
Miller, C. O.
SYNTHESIS OF IMPACT ACCELERATION TECHNOLOGY FOR AVIATION CRASH INJURY PREVENTION (PROJECT SIAT).—Flight Safety Foundation, Inc., New York, N. Y. (Contract DA 44-177-AMC-888(T)); issued by Army Transportation Research Command, Fort Eustis, Va. (Task no. 1AO24701A12101). TRECOM Technical Report no. 63-31A, June 1963. v+73 p.

The search and collation of currently available acceleration literature and related information of interest in aviation crash injury prevention are described. Approximately nine hundred documents unique to this study were catalogued and are available in a library at the Aviation Crash Injury Research facilities in Phoenix. Approximately 300 additional references of apparent applicability were also identified and are being obtained, where possible, at the time of this report's preparation. An information retrieval system was devised to facilitate future crash injury research using these data. Major categories in which information relative to impact acceleration was collected are as follows: hazard exposure, crash loads, human tolerance, design, and test/analysis methodology. (From the author's summary) (55 references)

1005
Miroliubov, G. P.
[ON THE MECHANISM OF THE PROTECTIVE EFFECT OF THE LIQUID MEDIUM DURING IMPACT ACCELERATIONS] K voprosu o mekhanizme zashchitnogo deistviia zhidkoi sredy ot udarnykh uskorenii.—Biofizika (Moskva), 7 (4): 468-472. 1962. In Russian.

Preliminary studies carried out on dummies indicated that the hydrostatic pressure during shock accelerations is subject to the laws of wave propagation. The data obtained were used in the design of experiments with dogs and rats. The animals were placed in containers filled with water or liquid gypsum of various density. In some experiments the walls of the container were lined with porous rubber to reduce hydrostatic pressure. This method increased the tolerance of the animals to impact accelerations from about 300 to about 625 g. Fitting gypsum casts for the body protected the animals exposed to accelerations up to 1000 g. Macroscopic examination of animals subsequently sacrificed did not reveal any pathological effects. It is concluded that the tolerance to impact is greatly enhanced by the increased support afforded by immersion in a liquid medium.

1006
Moskalenko, IU. E.,
R. M. Baevskii, and O. G. Gazenko.
[STUDY METHODS OF CEREBRAL BLOOD CIRCULATION IN THE CHANGED GRAVITATIONAL FIELD] K metodike issledovaniia mozgovogo krovoobrashcheniia v usloviiakh izmenennogo gravitatsionnogo polia.—Problemy kosmicheskoi biologii (Moskva), 1: 400-404. 1962. In Russian, with English summary (p. 404).

To study intracranial plethysmograms, a portable electroplethysmograph was developed. Laboratory tests indicate that the instrument fulfills all requirements. It was found to be particularly adaptable in experiments involving linear accelerations.

1007
Moskalenko, IU. E.
[THE POSSIBILITIES OF EXPERIMENTAL EVALUATION OF THE CEREBRAL BLOOD SUPPLY UNDER CONDITIONS OF AN ALTERED GRAVITATIONAL FIELD] O vozmoshnosti eksperimental'noi otsenki krovosnabzheniia golovnogo mozga v usloviiakh izmenennogo gravitatsionnogo polia.—Problemy kosmicheskoi biologii (Moskva), 2: 407-416. 1962. In Russian, with English summary (p. 416).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 414-423. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 36-21437)

The data obtained show the feasibility of studying the effect of the altered gravitational field on the cerebral blood supply in chronic experiments with animals by means of electroplethysmography. The curves registered contain valuable information about the condition of the blood supply of the human brain and about the intracranial pressure—the main factor which determines the blood supply of the brain—as well as on the regulation of the cerebral vascular system under conditions of the altered gravitational field (change of posture, acceleration).

1008
Moskalenko, IU. E.,
N. N. Benua, and O. V. Graunov
[DYNAMICS OF CEREBRAL BLOOD VOLUME DURING CHANGES IN THE DIRECTION OF THE

GRAVITATIONAL FIELD] Dinamika krovenapolneniia golovnogo mozga pri izmeneniiakh napravleniia gravitatsionnogo polia.—Fiziologicheskii zhurnal SSSR (Moskva), 49 (6): 405-411. April 1963. In Russian.

Forty anesthetized rats were exposed to the action of variable gravitational fields produced by changes in the position of the animals' body. The intracranial electroplethysmogram showed pulse waves of a mean amplitude of 0.1 ohm, respiratory waves of an amplitude of 0.2-0.3 ohm, and waves of the third order of a mean amplitude of 0.5 ohm. A negative gravitational field (head down) always caused a 1.0-1.5 ohm increase of resistance in the craniocerebral cavity, retention of the amplitude of the pulse waves at constant level, and an amplitude increase of the respiratory waves. The positive field (head up) effect was marked by an 1.5-2.0 ohm decrease of cerebrocranial resistance, no changes in the amplitude of the pulse waves, and an amplitude decrease of the respiratory waves.

1009
Moulton, G. A.,
W. G. Esmond, and M. Michaelis
EFFECT OF HYPERBARIC OXYGENATION ON NOBLE COLLIP DRUM SHOCK IN THE RAT.—Bull. School of Med., Univ. Maryland, 47 (3): 42-44. July 1962.

Two groups of adult male Wistar rats were subjected to tumbling in a Noble Collip-type drum at 40 r.p.m. for 800 to 840 turns. Following drumming, the experimental group was placed in an atmosphere of high pressure oxygen at 3 atmospheres absolute pressure for two hours. The control animals were allowed to recover in open cages. The survival rate 24 hours posttrauma was 81% for the experimental group and only 40% for the controls.

1010
Mráz, M.
CARBOHYDRATE METABOLISM FOLLOWING TRAUMATIZATION IN THE NOBLE-COLLIP DRUM AND SHOCK DUE TO BURNS IN RATS.—Physiologia bohemoslovenica (Prague), 12 (2): 145-149. 1963. In English.

Blood glucose and lactic acid levels and liver and muscle glycogen content were determined in rats exposed to the Noble-Collip drum or to scalding in boiling water. Animals adapted to the Noble-Collip drum, starved 24 hours previously, did not show the usual hypoglycemic response of fasted non-adapted rats. Adrenalectomized rats showed a pronounced hypoglycemia following trauma or scalding even if not starved previously. (Author's summary)

1011
Nakhapetov, B. O.
[REGIONAL HEMODYNAMIC INDICES DURING VESTIBULAR STIMULATION] Regionarni pokaznyky gemodynamiky pry vestybuliarnomu navantazhenni.—Fiziologichynyi zhurnal (Kyiv), 9 (3): 325-329. 1963. In Ukrainian, with English summary (p. 329).

Vestibular stimulation was induced in 289 subjects by exposing them to 30 turns on the Bárány chair (1 turn per 30 sec.). In general there were blood pressure changes throughout the arterial system, most pronounced in the peripheral regions: fluctuations of ± 30 mm. Hg were observed in arteries of the arm. Concomitantly there frequently occurred a decrease in cutaneous temperature in the temporal region. The author suggests that cutaneous temperature variations could be used as an additional index in the study of vestibular disturbances.

1012
Parin, V. V.,
O. G. Gazenko, and V. I. Iazdovskii
[POSSIBILITIES OF DEFENSIVE ADAPTATIONS OF THE ORGANISM AND ADAPTATION LIMITS DURING EXTREME ACCELERATIONS AND WEIGHTLESSNESS] Vozmozhnosti zashchitnykh prisposoblenii organizma i granitsy adaptatsii v usloviakh maksimal'nykh peregruzok i sostoianiia nevesomosti.—Vestnik Akademii meditsinskikh nauk SSSR (Moskva), 1962 (4): 76-81. 1962. In Russian.

As shown during the orbital flights of Vostok I and II, the most important factors affecting astronauts are as follows: acceleration, weightlessness, re-entry, cosmic radiation, and emotional tension. Transverse accelerations are most easily tolerated by the organism, but may produce respiratory, hemodynamic, and nervous disturbances. It was established that there is a direct relationship between blood flow rate and oxygenation. Electroencephalographic responses were similar in nature during hypoxia and during exposure to ionizing radiation. Results of experimental study of the action of acceleration in the central nervous system are described. With the aid of Aminazine [chlorpromazine] it was possible to block propagation of impulses at the level of the formatio reticularis of the midbrain. Comparison of data obtained during orbital flights and in centrifuge experiments showed an almost complete analogy. In general, no adverse effects were observed during weightlessness; but persistent unevenness of cardiac contractions and of respiration calls for special attention. Continuous efforts should be directed to study the roles of the afferent systems in weightlessness.

1013
Puxeddu, P.,
and D. Tarsitani
[RESEARCH ON THE THRESHOLD OF THE NYSTAGMIC REFLEX AFTER ACCELERATORY STIMULI] Indagini sulla soglia del riflesso nistagmico da stimoli acceleratori. — Bolletino delle malattie dell'orecchio della gola e del naso (Firenze), 80 (1): 73-91. Jan.-Feb. 1962. In Italian, with English summary (p. 88).

Test subjects were exposed to rotatory accelerations and decelerations of progressively increasing value from 0.2°-0.6°/sec.^{2}. Each run consisted of accelerations of the same physical value applied for 60 seconds. The first and third runs were associated with mental activity such as the answering of simple questions, performing a calculation, etc. When no nystagmic reaction was observed after a rest period of not less than thirty seconds, a successive run was carried out and the stimulus intensity increased by 0.1°/sec.^{2} but reversing the direction of acceleration in order to avoid habituation phenomena. Results showed that mental activity was effective in lowering the threshold of the nystagmic response. An average threshold value of about 0.4°/sec.^{2} was established for these subjects in comparison to previously reported values of 0.7°-0.8°/sec.^{2}. Since results were based on evident reactions observed by electronystagmographic recordings, it was assumed that the threshold of excitability of the ampullar receptor was even lower.

1014
Reeves, E.
THE EFFECT OF SEX ON THE G TOLERANCE OF RATS.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask MR005.13-0002.3, Report no. 7). Report no. NADC-MA-6313, Aug. 23, 1963. iv+10 p.

Three groups of rats were tested on the centrifuge at 20 positive g to ascertain what effect sex might have on the g tolerance of rats. The three groups were: (1) an experimental group of 50 female rats of about 4-1/2 months of age at time of centrifugation, (2) a control group of 50 male rats of the same age and (3) a control group of 85 male rats of about the same weight as the female experimental group. The experiment was performed to determine any differences between: (a) female and male rats of the same age, (b) female and male rats of the same weight, (c) female rats in the estrous as opposed to the diestrous phase of the estrus cycle and (d) female rats in the estrous or diestrous phase as compared to male rats of the same age or same weight. No significant differences were noted between the groups. (Author's abstract)

1015
Reeves, E.
THE EFFECT OF AGEING ON THE G TOLERANCE OF RATS. II. A COMPARISON AT ONE MONTH WITH SURVIVORS AT THREE MONTHS OF AGE.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask MR005.13-0002.3, Report no. 8). Report no. NADC-MA-6314, Aug. 26, 1963. iii+7 p.

A preliminary study indicated that young rats have a greater resistance to acceleration stress of 20 positive g than do more mature rats. The present study compared the tolerance of one-month-old rats with three-month-old rats at 20 positive g and found that there was a significant difference in favor of the one-month-old animals. Twenty rats which survived the initial centrifugation at one month of age were retested at three months and showed no significant difference in tolerance when compared with control rats of the same age. (Author's abstract)

1016
Rhein, L. W.,
and E. R. Taylor
RELATIVE BRADYCARDIA AFTER IMPACT. — Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850, Task no. 785001). Technical Documentary Report no. ARL-TDR-62-12, Aug. 1962. v+11 p.

An experiment was performed in which experimental subjects underwent a 15 g abrupt deceleration in both the forward- and backward-facing positions. A continuous electrocardiogram was made on all subjects. As compared with control subjects, a relative bradycardia of clinical and statistical significance occurred in the backward-facing position immediately after impact for at least five beats. This effect was virtually nonexistent in the forward-facing position. The possible mechanisms are discussed and the hypothesis is advanced that the relative bradycardia was due to a vagal reflex. (Authors' abstract)

1017
Rhein, L. W.,
and E. R. Taylor
INCREASED SKELETAL MUSCLE ACTIVITY FOLLOWING IMPACT.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850, Task no. 785001), Technical Documentary Report no. ARL-TDR-62-26, Dec. 1962. iii+7 p.

Seven male human subjects were exposed in the forward-facing position to impacts of -10 g, -20 g (400 g/second), and -20 g (800 g/second). An increase in skeletal muscle activity was seen following the 20 g exposures, with involuntary movements of the trunk and extremities. The activity was greater at the higher rate of onset. Possible explanations are discussed in this preliminary report, and the hypothesis of transient alteration of the central nervous system is advanced. (Authors' abstract)

1018
Rogers, T. A.
THE PHYSIOLOGICAL EFFECTS OF ACCELERATION. — Scient. American, 206 (2): 60-70. Feb. 1962.

A presentation is given of the physiological aspects of blackout including a discussion of forces acting on the body, blood pressure, circulation, and aircraft maneuvers producing blackout. Reddening of the visual field produced by pilots performing outside loops is discussed. Present-day research with the human centrifuge at the Naval Air Development Center in Johnsville, Pa., is described. A description of the large centrifuge is given. Various seating positions and restraining equipment are related to space flight, and speculations on the long-term effect of zero-g on blood, pressure receptors, salt balance, and excretion are given.

1019
Saitō, I.,
Y. Ueno, M. Ishizaki, and H. Fujihara
[EFFECTS OF ACCELERATION LOAD ON CIRCULATORY FUNCTION] [Abstract]. — Bōei Eisei (National Defense Medical Journal) (Tokyo), 9 (3): 26. March 1962. In Japanese.

Both men and dogs were exposed to forces of 5-10 g in a centrifugal-force apparatus. In dogs cardiac output decreased abruptly at 7-8 g and nearly ceased at 10 g. It appeared that the safe limit for life is at the point where nodal rhythm has been operating for no longer than 1 or 2 minutes. In the majority of dogs there was no evidence to show a lack of blood in the brain. Organs below the level of the heart were hyperemic as expected. In humans blackout occurred within a minute at 5-6 g.

1020
Saitō, I.,
Y. Ueno, and M. Ishizaki
[G-LOAD DURING SPECIAL FLIGHT IN THE T-33] [Abstract]. —— Bōei Eisei (National Defense Medical Journal) (Tokyo), 9 (3): 99-100. March 1962. In Japanese.

Four test pilots were used to determine the g-loads during various airplane maneuvers. For each maneuver the maximum g-load and the increase in the rate of g are given. The maneuvers tested were the vertical turn, loop, dive recovery, the Immerman turn, and the clover leaf. No adverse effects on visibility were found, and no differences in sensations from those of centrifugal-gravity simulators were noted.

1021
Saitō, I.,
and M. Ishizaki
[EFFECT OF ACCELERATION G LOAD ON BRAIN FUNCTION EVALUATED BY THE FLICKER TEST] [Abstract]. —— In: Abstracts of the 7th Meeting of the National Defense Medical Society. Bōei Eisei (National Defense Medical Journal) (Tokyo), 9 (3): 101. March 1962. In Japanese.

Flicker fusion frequencies (FFF) indicated the occurrence of fatigue in men subjected to 3-5 g. There was a 1.9 to 28% decrease in FFF over the range of 3-5 g with an abrupt drop occurring between 4 and 5 g. Within a minute after stopping the centrifuge, more than 90% of the subjects recovered. This method makes it possible to predict the susceptibility to fatigue with 99% accuracy.

1022
Saitō, I.,
and M. Ishizaki
[EFFECT OF ACCELERATION LEVEL ON RESPIRATORY FUNCTION] [Abstract]. —— In: Abstracts of the 7th Meeting of the National Defense Medical Society. Bōei Eisei (National Defense Medical Journal) (Tokyo), 9 (3): 101. March 1962. In Japanese.

In a horizontal position and under a load of 6 g, 17 men from 24 to 41 years of age breathed either air or 100% oxygen. With oxygen, dry coughing, wheezing, difficulty in breathing, and pulmonary trunk noise were significantly more frequent than when air was breathed. Tidal volume, lung volume, and complementary volume decreased more significantly under oxygen than under air. When pure oxy- was breathed, edema, stagnation, constriction, and local anoxia were observed.

1023
Schoeck, P.,
and F. Halberg
EFFECTS OF DECELERATION IN MAN ON PLASMA 17-HYDROXYCORTICOSTEROIDS. —— Minnesota Med., 45 (6): 625-631. June 1962.

A 34 year-old male volunteer was subjected to rapid acceleration followed by prompt deceleration. Plasma hormone determinations were made 15, 30, and 105 minutes following a crash against a wall at 25 m.p.h. These 17-hydroxycorticosteroid values seem significantly elevated, compared with the mean values expected at corresponding times when a two-fold standard of comparison is used. A 24-hour profile on the same subject on an uneventful day is made available for comparison. (Authors' summary, modified) (25 references)

1024
Smith, E. E.,
and A. C. Guyton
CENTER OF ARTERIAL PRESSURE REGULATION DURING ROTATION OF NORMAL AND ABNORMAL DOGS.—Amer. Jour. Physiol., 204 (6): 979-982. June 1963.

Dogs were rotated about a horizontal transverse axis. By shifting the axis of rotation along the length of the animal's body it was possible to find a point at which arterial pressure remained almost constant in all positions of rotation. In most normal dogs such an axis lay in the neck a few centimeters cephalad to the sternum. Denervation of carotid sinus and aortic pressoreceptors caused a caudal shift of the axis; total spinal anethesia did also, and to a much greater degree. This study demonstrates that pressure-regulatory mechanisms operate to maintain a constant arterial pressure in the neck, probably for the minimizing of postural alterations cerebral blood flow. (Authors' abstract)

1025
Snyder, R. G.
A CASE OF SURVIVAL OF EXTREME VERTICAL IMPACT IN SEATED POSITION. —— Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Oklahoma. Report no. 62-19, Oct. 1962. 15 p.

Physical, biophysical, and medical data are presented concerning the case of a 20-year-old male of excellent physical condition who jumped from the Golden Gate Bridge in San Francisco and survived for ten days a free-fall deceleration in the seated position (buttocks to head) of a calculated 4128 g for .0023 seconds. Specific trauma resulting from this impact indicates that this may closely approach the extreme human survival tolerance to impact in this position, and that, while distribution of forces through support of the upper torso may greatly minimize injury to the skeletal system, protection of internal organs will present a much more difficult problem. (Author's abstract)

1026
Squires, R. D.,
R. E. Jensen, and W. C. Sipple
ELECTROENCEPHALOGRAPHIC CHANGES IN HUMAN SUBJECTS DURING BLACKOUT PRODUCED BY POSITIVE ACCELERATION [Abstract]. —Electroencephalography and Clinical Neurophysiol. (Amsterdam), 15 (1): 164-165. Feb. 1963.

Thirteen human subjects were subjected alternately to a set of peak accelerations of 6 and 7 g on two separate occasions. Peak g was attained in approximately 30 seconds. Electroencephalograms were recorded from the right and left side of the calvaria, 2 cm. above and lateral to the occipital protuberance. Frequency analysis showed characteristic changes during visual greyout and blackout. An increase in beta frequencies, 16-36 c./sec. occurred with the same general amplitude pattern as the acceleration profile. The lower beta frequencies, 16-19 c./sec. tended to level out or decrease during each blackout coincident with an increase in the lower frequency components. The alpha frequencies, 8-13 c./sec. often appeared during greyout and blackout, but tended to disappear during very deep blackout when bursts of high amplitude low frequency components appeared. The best index of the level of consciousness appears to be the inverse relationship between the depth of blackout and the amplitude of EEG frequencies in the range of 5 c./sec. The 5 to 7 c./sec. frequency band is associated with the cerebral hypoxia which occurs during positive acceleration. This frequency band was also shown to be related to performance of specific performance tasks. (Quoted in part)

1027
Stiehm, E. R.
DIFFERENT EFFECTS OF HYPOTHERMIA ON TWO SYNDROMES OF POSITIVE ACCELERATION. — Jour. Applied Physiol., 18 (2): 387-392. March 1963.

The tolerance to high positive (headward) acceleration at levels of 20-80 g was studied in normal and hypothermic rats. Normal rats have a mean survival time of 680 seconds at 20 g, but this decreases to 105 sec. at 30 g. Only slight decreases are noted at higher g, suggesting that 30 g is the point at which cerebral circulation is interrupted. Hypothermia at 22.5° C. decreases acceleration tolerance at 20 g, but markedly increases acceleration tolerance at 30 g and above. At 40 g this effect is maximal, and the mean survival time for hypothermic rats is 252 sec., compared to 75 sec. for controls, an increase of 236%. These different effects of hypothermia on acceleration tolerance suggest that there are two distinct syndromes of physiologic failure during positive acceleration. One is a "cardiac" syndrome, occurring at 20 g and below, characterized by partial maintenance of cerebral circulation until cardiac failure ensues, and the other is a "cerebral" syndrome, occurring at 30 g and above, characterized by immediate interruption of cerebral circulation and respiratory paralysis. (Author's abstract)

1028
Stiehm, E. R.
THE EFFECT OF HYPOTHERMIA ON THE RATS TOLERANCE TO HIGH POSITIVE ACCELERATION WITH EVIDENCE FOR THE EXISTENCE OF DIFFERENT ACCELERATION SYNDROMES AT HIGH AND LOW G. — Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Subtask no. MR005.13-0002.15, Report no. 3). Report no. NADC-MA-6203, May 31, 1962. [26] p.

The tolerance to high positive acceleration at levels of 20 to 80 g was studied in normal and hypothermic rats. Normal rats have a mean survival time at 20 g of 680 seconds but this decreases to 105 sec. at 30 g. Only slight further decreases are noted at higher g, suggesting that 30 g is the point at which cerebral circulation is interrupted. Hypothermia at 22.5° C. decreases the tolerance of rats to 20 g positive acceleration but markedly increases their tolerance to 30 g and above. The beneficial effect of hypothermia was most pronounced at 40 g at which level hypothermic rats have a mean survival time of 252 sec. compared to that of control rats of 75 sec., an increase of 236%. The ECG is useful as an indication of death at 20 g but not at 30 g or above. Animals that do not survive high g levels die of respiratory paralysis despite good heart action. Hypothermia must make the respiratory center less sensitive to the deleterious effect of hypoxia. There seem to be two distinct syndromes of physiologic failure during positive acceleration. One is a "cardiac" syndrome, occurring at 20 g and below, characterized by partial maintenance of cerebral circulation until cardiac failure ensues, and the other is a "cerebral" syndrome, occurring at 30 g and above, characterized by immediate interruption of cerebral circulation. Agents such as hypothermia, which increase tolerance at one level of positive acceleration, will not necessarily be of benefit at another level.

1029
Taylor, E. R.,
L. W. Rhein, and G. R. Beers
EFFECT OF ATROPINE UPON THE RELATIVE BRADYCARDIA ASSOCIATED WITH IMPACT. — Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850, Task no. 785001). Technical Documentary Report no. ARL-TDR-62-13, Aug. 1962. v+7 p.

The relative bradycardia immediately following impact in the backward-facing configuration at 15 g is demonstrated to be abolished completely in humans by the intramuscular injection of 1.6 milligrams of atropine sulfate 45 to 60 minutes preceding impact. This evidence supports the hypothesis previously advanced that bradycardia is due to a vagal reflex from an undetermined sensor system and mediated through the vagus nerve to the heart. (Authors' abstract)

1030
Taylor, E. R.,
L. W. Rhein, and J. F. Ferguson
THE EFFECT OF IMPACT UPON THE PATELLAR AND OTHER DEEP TENDON REFLEXES. — Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850, Task no. 785001). Technical Documentary Report no. ARL-TDR-62-18, Aug. 1962. v+9 p.

Alterations of the deep tendon reflexes have been frequently observed in humans after impact. A series of experiments was conducted to study reflexes in humans undergoing a 15 seat g impact, with a control group undergoing a 5 seat g impact. Using standard clinical examination and notation techniques, no quantitative differences were noted between the experimental and control groups. In the opinion of the medical examiners, however, a slight increase in "briskness" was found in the experimental group in contrast with the control group. Development of a reflex sensor suitable for sled testing is necessary for further work in this investigation. (Authors' abstract)

1031
Taylor, E. R.,
and L. W. Rhein
A COMPARISON OF METHODS OF IMPACT EXPERIMENTATION CONTROL. — Aeromedical Research Lab. (6571st), Holloman Air Force Base,

New Mexico (Project no. 7850, Task no. 785001). Technical Documentary Report no. ARL-TDR-62-19, Aug. 1962. v+9 p.

Impact testing of human subjects has recently demonstrated certain differences between experimental subjects and control subjects. The validity of using, as a control, subjects undergoing acceleration and minimal impact as compared with using subjects undergoing deliberate abort at the completion of countdown was tested, using heart rate as the criterion for comparison. Subjects undergoing acceleration and minimal impact were found to have a statistically significant increase in heart rate immediately post-impact as compared with the subjects not fired. This effect is attributed to preliminary acceleration; since experimental subjects undergo preliminary acceleration also, control subjects should undergo actual acceleration and minimal impact. (Authors' abstract)

1032
Taylor, E. R.
THROMBOCYTOPENIA FOLLOWING ABRUPT DECELERATION: A PRELIMINARY COMMUNICATION.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850, Task no. 785001). Technical Documentary Report no. ARL-TDR-62-30, Dec. 1962. iv+13 p.

A series of six progressively severe abrupt acceleration tests was conducted on seven human sled subjects in the forward-facing position, with the final two impacts on each subject being-20 g peak, at an onset rate of 800 g/sec. Thrombocyte counts made before, 1 hour after, and 24 hours after impact revealed a one-hour post-impact decrease of major proportion, with full recovery to mean pre-impact thrombocyte concentrations by 24 hours post-impact. An elevation of pre-impact (baseline) thrombocyte counts occurred after the first and fifth tests. Various possible mechanisms for this effect are presented, and areas of potential use are outlined. (Author's abstract)

1033
Taylor, E. R.
PROBLEMS AND TECHNIQUES OF HUMAN SLED SUBJECT SELECTION.—Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850). Technical Documentary Report no. ARL-TDR-63-5, March 1963. v+8 p.

Present methods of human sled subject selection for abrupt acceleration are enumerated. The problem in validity of selection from the population at risk, while maintaining safety, is discussed. Selection examinations include medical history and physical examination, X-ray photographs, anthropometry, neurological evaluation, electroencephalography, clinical psychological appraisal, laboratory measurements, electrocardiography, trial impact, and prolonged clinical appraisal. (Author's abstract)

1034
Taylor, E. R.
BIODYNAMICS: PAST, PRESENT AND FUTURE.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850). Technical Documentary Report no. ARL-TDR-63-10, March 1963. v+19 p.

A brief operational definition of biodynamics is presented. Following a condensed history of the field, including a review of weaknesses of the transient mechanical analytic approach, present biological research activities are listed. A definition of working relationships between disciplines is advanced. (Author's abstract)

1035
Triner, L.,
M. Mráz, and M. Chmelařova.
THE EFFECT OF GLUCOSE AND GLUCOSE TOGETHER WITH INSULIN ON THE RESISTANCE OF FASTED RATS TO TRAUMA IN THE NOBLE-COLLIP DRUM.—Physiologia bohemoslovenica (Praha), 12 (2): 136-144. 1963. In English.

This study demonstrates that the administration of glucose together with insulin (1 U/g. glucose) significantly increases the resistance of rats fasted for 24 hours to trauma in the Noble-Collip drum as compared to solutions of saccharose, saline, and dextrane. Sorbitol did not differ from glucose plus insulin in its effect, and this might be due to the fact that it is readily metabolized as judged from increased liver glycogen and blood glucose levels. The authors suggest a positive correlation between muscle glycogen content before and after trauma and resistance to trauma. (Authors' summary, modified) (32 references)

1036
Vacca, C.,
and C. Koch
[EFFECT OF THE VASOMOTOR REFLEXOGENIC ZONES ON VESTIBULAR FUNCTION IN THE RABBIT SUBJECTED TO HIGH TRANSVERSE ACCELERATIONS] Influenza delle zone reflessogene vasosensibili sulla funzione vestibolare nel coniglio sottoposto ad elevate accelerazioni transversali.—Rivista di medicina aeronautica e spaziale (Roma), 25 (4): 641-652. Oct.-Dec. 1962. In Italian, with English summary (p. 649-650).

Normal rabbits subjected to successive accelerations of 3, 6, and 9-10 g on a centrifuge showed a marked decrease in the duration, amplitude, and frequency of nystagmus related to g increases. Nystagmus almost disappeared at 6 and 9-10 g. Simultaneous electrocardiographic records showed heart rate changes of an adaptive nature at the onset of acceleration, while no variations were recorded in the steady state. Nystagmic beats were not observed after denervation of vasomotor zones of the glossopharyngeal, Cyon's and vagus nerves at neck level during steady acceleration of similar magnitude and duration. However, they appeared after the end of the experiment, somewhat reduced in duration, amplitude and frequency. The electrocardiogram revealed more frequent and intense fluctuations of heart rate, both increases and decreases, particularly at 6 and 9-10 g as compared to recordings made before denervation. The signs of myocardiac-coronary damage increased and return to the basal state at the end of rotation was slower. Some animals died at 9-10 g. These experiments show that peripheral afferent stimuli originating from vasomotor areas exert some influence on labyrinthine function while denervation reduces the animal's tolerance to transverse acceleration.

1037
Vasil'ev, P. V.,
A. D. Voskresenskii, and O. G. Gazenko
[EXPERIMENTAL STUDIES IN SPACE PHYSIOLOGY] Eksperimental'nye issledovaniia v kosmicheskoi fiziologii.—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1963 (1): 15-23. Jan.-Feb. 1963. In Russian, with English summary (p. 23).

Either empirical or theoretical approaches are possible in the field of space physiology. A diagram of the effects of transverse acceleration on organ systems is given, and the significance of oxygen tension in the tissues, hemodynamics, and nervous mechanisms during space flight are considered. No new experimental data are reported. The authors conclude that it is possible to construct a model which will show the physiological effects of space flight; such a model could prove invaluable in the prognosis of the physical condition of cosmonauts and in the solution of problems related to their safety.

1038
Vinnikov, Ia. A.,
O. G. Gazenko, L. K. Titova, and A. A. Bronshtein
[A MORPHOLOGICAL AND HISTOCHEMICAL STUDY OF THE ANIMAL LABYRINTH IN THE CHANGED GRAVITATIONAL FIELD] Morfologicheskie i gistokhimicheskie issledovaniia labirinta zhivotnykh v usloviiakh izmenennogo gravitatsionnogo polia.—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1963 (2): 222-231. March-April 1963. In Russian, with English summary (p. 231).

Cats and guinea pigs were exposed to accelerations of various magnitudes on a centrifuge. The utricles of the test animals were removed and whole mounts as well as serial sections prepared. In the histological preparations, reactions for the demonstration of proteins, nucleic acids, and various other stains were applied. In the utricular cells of guinea pigs, exposed to 10 g for 3 min., the nucleoli moved from the nucleons towards the basal part of the ciliary cells. This movement proceeded along the vector of the gravitational field. Concomitant studies of the utricular receptor cells showed a decline in cytoplasmic ribonucleic acid (RNA) content, in total protein, and in protein bound sulphydryl and carboxyl groups. A parallel decrease in oxidative enzyme activity of the mitochondria and of the acetylcholine esterase in the synaptic region was noted. Some neurons of the vestibular ganglion showed a decline in ribonucleic acid (RNA) content of the Nissl bodies and nucleoli, and a concomitant decline in the activity of oxidative enzymes, of the intracellular acetyl choline esterase, and of the total protein. Upon cessation of acceleration, the utricular receptors and the vestibular ganglion cells completely recovered within 14 days.

1039
Watson, J. F.,
and R. M. Rapp
EFFECT OF FORWARD ACCELERATION ON RENAL FUNCTION. —— Jour. Applied Physiol., 17 (3): 413-416. May 1962.

The effect of forward acceleration on renal hemodynamics, electrolyte excretion, and water clearance was studied in six normal human subjects. Forward acceleration produced a slight increase in glomerular filtration rate and effective renal plasma flow during and after stress. After centrifugation there was a 20-35 minute lag before the appearance of an increase in urine volume and free water clearance. These changes in water excretion were transient and were not accompanied by a natriuresis nor associated with changes in serum osmolality. Physiologic responses to forward acceleration and negative pressure breathing were compared. It is suggested that forward acceleration, like negative pressure breathing, may induce an increase in intrathoracic blood volume which inhibits the release of antidiuretic hormone via a nonosmotic volume-sensitive receptor mechanism located within the intrathoracic vascular space. (Authors' abstract)

1040
Weaver, J.,
M. Rubinstein, C. C. Clark, and R. F. Gray
ENCAPSULATION OF HUMANS IN RIGID POLYURETHANE FOAM FOR USE AS A RESTRAINT SYSTEM IN HIGH ACCELERATION ENVIRONMENTS. —— Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (WepTask no. RAE 20J 010/2021/F012 10 002, Problem Assignment no. 010AE22-9). Report no. NADC-MA-6147, May 31, 1962. v+47 p.

Molded seats and couches have the advantages of distributing accelerative loads developed by the user's body across the maximum possible area. This report discusses experiments with complete encapsulation of humans in rigid casts of polyurethane foam for periods of more than two hours. The procedures discussed were judged by a subject to give better support in an acceleration environment than other forms of human restraint tested at the Aviation Medical Acceleration Laboratory, U. S. Naval Air Development Center, Johnsville, Pa. Considerable progress in solving the problems associated with casting humans in this material was made during these experiments. It was found possible to form a complete rigid cast around a human in five minutes and possible to remove this cast in less than three minutes. Subjects have stayed encapsulated in foam casts for periods of up to 30 minutes without special provisions for cooling. Ventilatable garments permit persons to stay encapsulated in the foam for periods of at least two hours. The immobilization leads to muscle and joint pain which increases with time and sets limits on tolerance to being submerged in this type of rigid cast. (Authors' abstract)

1041
White, W. J.
QUANTITATIVE INSTRUMENT READING AS A FUNCTION OF ILLUMINATION AND GRAVITATIONAL STRESS. —— Jour. Engineering Psychol., 1 (3): 127-133. July 1962.

This study investigated whether or not a pilot's ability to read aircraft instrument dials at various brightness levels is impaired by accelerative force less than that required to produce temporary blindness. Six subjects with a visual acuity of 20/20 or better, clad in a CSU-3/P anti-G suit, were exposed to positive acceleration levels ranging from 1 to 4 g (at least 1 g unit below that at which dimming of peripheral vision would occur). The results indicate the following: (a) at the highest luminance level there are no differences in the percentage of errors among the four acceleration conditions; (b) at the three highest luminance levels, for values up to 3 g, there are no significant differences in the percentage of reading errors; (c) at the two lower luminance levels errors are inversely related to luminance and directly related to acceleration; (d) at the 4-g conditions there is a systematic increase in errors with decreasing brightness; and (e) the 2-g level of acceleration cannot be distinguished from the 1 g or static condition.

1042
Whiteside, T. C. D.
SMALL EYE MOVEMENTS DURING VERTICAL ACCELERATION. —— Revue de médecine aéronautique (Paris), 1 (4): 35-37. July-Aug. 1962. In English.

Subjects seated in a lift cabin with the head immobilized were exposed to two lines of light produced by flashing discharge tubes to the right and left of a fixation point. The first flash, on one side, took place 5 milliseconds before the start of the drop (from 1 g to 0 g). The second flash, on the other side, occurred at varying times 0 to 110 milliseconds after the start of the drop. The subject observed a lined card and against this measured the separation of the two afterimages after each drop. Up to about 30 millisec. from the start of the drop there was no consistent separation of the afterimage but with increasing time from the start of the drop, the separation tended to increase, becoming greatest about 80-100 millisec. after the start of the drop. This separation of afterimages indicates a deviation of the eyes in the upward direction. A further experiment carried out with the flash unit 1/3 of the distance previously employed showed a somewhat greater separation of afterimages than previously recorded. Although the time relations could not be determined with accuracy, eye movements were occurring 20-30 millisec. after the appearance of the stimulus of linear acceleration acting in a constant direction.

1043
Winget, C. M.,
Arthur H. Smith, and C. F. Kelly
EFFECTS OF CHRONIC ACCELERATION ON INDUCED NYSTAGMUS IN THE FOWL. —— Jour. Applied Physiol., 17 (4): 709-711. July 1962.

Domestic fowl exposed to chronic acceleration (prolonged centrifugation) do not appear to "habituate" to repeated rotatory stimulation, as do similarly treated birds maintained at normal gravity. Chronically accelerated birds frequently exhibit postural or locomotor abnormalities, and such individuals lack a nystagmic response to rotatory stimulation. (Authors' abstract)

1044
Zechman, F. W.,
and J. Taylor
RESPIRATORY RESPONSE TO FORWARD ACCELERATION COMPARED WITH CHEST COMPRESSION IN DOGS. —— Jour. Applied Physiol., 17 (3): 410-412. May 1962.

Six mongrel dogs were studied to determine if the increases in frequency of breathing characteristic of both chest compression and forward acceleration are initiated by the same vagal reflex. Since vagal section only abolished the response to chest compression, it is assumed that some other mechanism is primarily responsible for the rate increase characteristic of forward acceleration. Experiments are also described which suggest that the increased respiratory frequency may be attributed to a hypoxic drive. (Authors' abstract)

1045
Zechman, F. W.,
and G. Mueller
EFFECT OF FORWARD ACCELERATION AND NEGATIVE PRESSURE BREATHING ON PULMONARY DIFFUSION. —— Jour. Applied Physiol., 17 (6): 909-912. Nov. 1962.

Forward acceleration decreases lung volumes, resembling negative pressure breathing (NPB). At 4 g the relaxation pressure curve is shifted downward and to the right 15 mm. Hg. Pulmonary gas exchange and diffusion capacity were measured in nine human subjects during NPB (-15 mm. Hg) and forward acceleration (4 g). Pulmonary ventilation increased approximately 40% in each condition. The oxygen uptake increased with NPB (from 261 to 293 ml./min.) and was slightly decreased or unchanged at 4 g. Carbon dioxide elimination increased in both experimental conditions. The apparent steady-state carbon monoxide diffusion was unchanged by NPB but decreased from an average control value of 21 to 12 ml./min. mm. Hg at 4 g. Since lung volumes are decreased by comparable amounts in both conditions, it is believed that the deleterious effects observed with forward acceleration are associated with the increased hydrostatic gradient from chest to back. (Authors' abstract)

c. Subgravity

1046
Borshchevskii, I. Ia.,
G. M. Beliakov, N. N. Gurovskii, V. S. Kuznetsov, and E. M. Iuganov
[EXPERIENCE IN THE STUDY OF THE QUALITY OF RECEPTION AND TRANSMISSION OF SPEECH UNDER CONDITIONS OF WEIGHTLESSNESS] Opyt izucheniia kachestva priema i peredachi rechi v usloviiakh nevesomosti.—Problemy kosmicheskoi biologii (Moskva), 2: 215-219. 1962. In Russian, with English summary (p. 219).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 229-233. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

This article reports the results of determining the quality of reception and transmission of a pilot's speech under conditions of a short period of weightlessness. The studies showed that changes in speech quality during weightlessness are insignificant and do not exclude the possibility of maintaining good communication under these conditions. (Authors' summary, modified)

1047
Diringshofen, H. von
[IMMERSION IN WATER AS A PARTIAL SIMULATOR OF WEIGHTLESSNESS IN SPACE MEDICINE] Das Wasserbad als Teilsimulator der Gewichtslosigkeit in der Raumfahrtmedizin. — Archiv für physikalische Therapie (Leipzig), 14 (4): 307-311. July-Aug. 1962. In German.

Research on weightlessness employing water-tank type simulators is reviewed in the light of Titov's experience in space flight. Certain disturbances in the physiological functions seen in the experiments were caused by the hydrostatic pressure of the water. A progressive muscular asthenia with increasing tendency to orthostatic collapse developed in the experimental subjects as a direct effect of the hypodynamic environment. This tendency still persisted two days after the seven-day experiment in the water-tank simulator. The lowered stress resistance was evidenced by lowered acceleration tolerance, lowered physical efficiency in the presence of unimpaired muscle strength, and in particular by lowered sensorimotor performance. The electroencephalogram showed a disturbance in the sleep-wakefulness cycle, i. e., frequent intervals of light sleep or lowered consciousness and only two hours of deep sleep. Recommendations include a program of systematic physical exercise aboard the space ship to maintain muscle and cardiovascular tonus, and training of spatial orientation to compensate for the non-function of the otoliths in zero-gravity conditions.

1048
Gerathewohl, S. J.
OPERATIONAL ASPECTS OF WEIGHTLESSNESS.— Proceedings of the Lunar and Planetary Exploration Colloquium, 3 (2): 141-144; discussion, p. 144-145. May 5, 1963.

Man's tolerance to weightlessness directly affects the design specifications of space vehicles and the realization of Project Apollo, manned orbital space stations, and interplanetary flights. Early experiments in aircraft, ballistic missiles, and in Project Mercury have shown that short-term weightlessness provides a tolerable environment. Selected and conditioned pilots can move freely, remain oriented, and work efficiently, if common-sense preventive measures are taken. However, Titov experienced attacks of nausea and vertigo after about 6 hours during his 27-orbit flight. It is concluded that the untoward effects are neurophysiologic in nature. Further experiments with humans and animals are necessary to solve the problems of long-term weightlessness. (Author's abstract)

1049
Gerathewohl, S. J.
PERSONAL EXPERIENCES DURING SHORT PERIODS OF WEIGHTLESSNESS IN JET AIRCRAFT AND ON THE SUBGRAVITY TOWER.—In: Symposium on motion sickness with special reference to weightlessness, p. 73-80. Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-63-25, June 1963.

Experiments on weightlessness were performed in short periods during jet flight parabolas and in one exposure on the subgravity tower. The effects of acceleration were difficult to separate from those of weightlessness. Motion sickness symptoms produced in many instances may be related to (1) a naturally low threshold to motion sickness; (2) a (perhaps pathologically) low threshold for a permanent change in gravireceptoric input which might prevent the adaptation to a permanent state of weightlessness anticipated in orbital or space flights; (3) stimulation of the semicircular canals during weightlessness elicited by voluntary or involuntary movements; (4) psychological and emotional effects; (5) physiological factors associated with jet flights, such as changes in cabin pressure, oxygen, and temperature. (From the author's conclusions)

1050
Grandpierre, R.,
and F. Violette
[CONTRIBUTION TO THE STUDY OF THE EFFECTS OF WEIGHTLESSNESS ON THE RAT CENTRAL NERVOUS SYSTEM] Contribution à l'étude des effets de l'apesanteur sur le système nerveux central du rat.—In: Life sciences and space research, p. 33-38. Ed. by R. B. Livingston and others. Amsterdam: North-Holland Publishing Co., 1963. In French, with English abstract (p. 33-34).

The effects of weightlessness on the physiological activity of the nervous system of white rats were determined during one rocket flight and in a series of parabolic flights in an airplane. The periods of weightlessness lasted from 33 to 44 seconds. Cortical and mesencephalic electrical activity, neck muscle electrical activity, cardiac rate, and respiratory rate were measured. During the rocket flight, intense cortical activity was recorded but the mesencephalic activity was unchanged. During weightlessness in the airplane basic brain electrical activity was not modified. Recording of neck muscle potentials, however, showed an augmentation of background noise which is possibly of reticular origin as a result of the abrupt diminution of volume of sensory information following the disappearance of the gravity stimulus. The effects on cardiac and respiratory rate are not given.

1051
Grandpierre, R.,
R. Angiboust, R. Brice, B. Cailler, G. Chatelier, J. Ginet, P. Grognot, and F. Soret
[NERVOUS SYSTEM ACTIVITY IN THE WHITE RAT DURING SHORT PERIODS OF WEIGHTLESSNESS] Activité de système nerveux du rat blanc pendant de courtes périodes de non gravité.—Revue de médecine aéronautique (Paris), 2 (8): 400-405. Aug.-Sept. 1963. In French.

The physiological reactions of white rats to short periods of weightlessness were measured in a series of experiments carried out in aircraft or rockets. Electroencephalographic tracings were made on the cortex and mesencephalon, and electrodes were also inserted on the neck muscles at the base of the head. The tracings suggested that cortical function remains normal, but the central nervous system shows epileptic phenomena.

1052
Graveline, D. E.,
and M. McCally
SLEEP AND ALTERED PROPRIOCEPTIVE INPUT AS RELATED TO WEIGHTLESSNESS: WATER IMMERSION STUDIES. —— Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722201). Technical Documentary Report no. AMRL-TDR-62-83, Aug. 1962. iii+12 p.

The "free-floating" condition of immersion is associated with substantial alterations in mechanoreceptive feedback to the central nervous system in a manner similar to the free-floating condition of weightlessness. One area having rather immediate operational application concerns sleep under these conditions. In this study electroencephalographic and electrooculographic recordings were made during sleep of completely immersed, neutrally buoyant subjects. Sleep records were obtained while using both tether and clamshell sleeping facilities and were compared to each subject's normal bedrest sleep records. The results are presented, and their possible application to prolonged weightlessness is discussed. (Authors' abstract)

1053
Graybiel, A.
SIGNIFICANCE OF VESTIBULAR ORGANS IN PROBLEMS OF WEIGHTLESSNESS.—In: Life sciences and space research, p. 19-32. Ed. by R. B. Livingston and others. Amsterdam: North-Holland Publishing Co., 1963

Two important questions concerning the organs of equilibrium are posed by orbital and space flights. The first is whether exposure to weightlessness may evoke symptoms of vestibular origin, and the second is how to prevent symptoms of vestibular origin should it be decided to abolish weightlessness by causing the spacecraft to spin. It is important to determine whether vestibular symptoms are to be ascribed to the otolith apparatus or to the semicircular canals, or to both. During exposure to weightlessness the usual gravitational stimulus to the otolith apparatus is lost, and this reduction in afferent input might be expected to disturb the integrative patterns in the central nervous system. If orbiting vehicles are rotated to abolish weightlessness, very short radii will expose the body variations in centripetal force and longer radii, by the stress of constant rotation combined with head movements, will generate Coriolis effects which may result in illusions and "canal sickness". (Author's abstract, in part) (32 references)

1054
Hammer, L. R.
PERCEPTION OF THE VISUAL VERTICAL UNDER REDUCED GRAVITY. —— Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. MRL-TDR-62-55, May 1962. iv+13 p.

Judgments of the vertical in an unstructured visual field were obtained in flight under four levels of gravity ranging from 0 g to 1 g. Reduced- and zero-gravity conditions were produced in a cargo aircraft flying a parabolic trajectory. Each of 16 subjects made 6 judgments under each of the four gravity conditions. Results indicate that, although error of judgment of the vertical is not large, it does increase as the g-level decreases, from 1.8 degrees at 1 g to 3.5 degrees at 0 g. Conditions associated with inflight research are discussed and suggestions for future research are presented. (Author's abstract) (31 references)

1055
Hawkins, W. R.
SPACE FLIGHT DYNAMICS—WEIGHTLESSNESS. —In: Physiology of man in space, p. 287-307. Ed. by J. H. U. Brown. New York and London: Academic Press, 1963.

A short summary of the limits of weight and the atmosphere, a historical review, and methods of studying weightlessness are briefly discussed. Research data from many studies on neuromuscular reflexes, vision and hallucinations, nutrition, initiation of micturition, and circulation time during weightlessness are analyzed. Evidence thus far collected from subgravity experiments indicate that adequate compensation or adaptation of the cardiorespiratory system takes place within the tolerance limits of man and that manned space flight will be safe.

1056
IUganov, E. M.,
P. K. Isakov, I. I. Kas'ian, D. V. Afanas'ev, and G. I. Pavlov
[MOTOR ACTIVITY OF INTACT ANIMALS SUBJECTED TO ARTIFICIAL GRAVITY] Dvigatel'naia aktivnost' intaktnykh zhivotnykh v usloviiakh iskusstvennoi sily tiazhesti.—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1962 (3): 455-460. May-June 1962. In Russian, with English summary (p. 460).

A determination was made of the minimal value of gravity necessary for the maintenance of normal posture and coordination. Rats and mice were subjected to rides on a centrifuge mounted in aircraft flying in a ballistic trajectory. They were exposed to centrifugal stresses of 0.05-1.0 g while their reactions were filmed. During weightlessness the animals rotated chaotically in various planes or sometimes remained motionless while attempting to restore equilibrium by spreading their legs and by tail movements. With the onset of artificial gravity the motor activity began to approach that of controls, and became normal at 0.28-0.3 g. The authors conclude that artificial gravity of 0.28-0.3 g could be considered effective in insuring normal motor activity of test animals during brief periods of weightlessness.

1057
IUganov, E. M.,
I. I. Kas'ian, M. A. Cherepakhin, and A. I. Gorshkov
[SOME HUMAN REACTIONS UNDER SUBGRAVITY CONDITIONS] O nekotorykh reaktsiiakh cheloveka v usloviiakh ponizhennoi vesomosti.—Problemy kosmicheskoi biologii (Moskva), 2: 206-214. 1962. In Russian, with English summary (p. 214).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 219-228. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The study of sensory and motor reactions in weightless conditions and of the adaptation to such conditions permits an arbitrary classification of individuals into three reactive types. During the initial exposure to weightlessness various changes can occur in indices of the strength of the movement. There is a regular marked reduction of the amplitude of action potentials obtained from the neck musculature. The authors suggest the use of parabolic flights on airplanes not only for the solution of scientific problems but also as a means of selection and training of future astronauts.

1058
Jones, Edward W.
WHAT DOES "WEIGHTLESSNESS" REALLY MEAN? — Space-Aeronautics, 38 (5): 65-67. Oct. 1962.

A discussion is presented of the dynamic aspects of suborbital, orbital, and escape flight in relation to weightlessness and gravity, with detailed calculations and formulas. When a body is exposed to the gravitational acceleration towards the Earth's center, and the rate of change of the velocity of fall is equal to g, the body is in free fall and in a state of null gravity. In a suborbital flight during re-entry, the body of a 161 pound astronaut may reach a weight of 1760.9 pounds. If the rate of change of velocity exceeds acceleration due to gravity the astronaut may take on negative weight. In an orbital flight on a true spherical path there is a weightless state because there is no net stress or strain on the body in respect to the Earth's center or a point along the orbit path. Zero gravity can not occur in these circumstances, but can only be found at a point where the gravitational field of one body cancels that of another such as between the Moon and Earth. Problems of orientation of the astronaut in relation to gravitational forces are discussed.

1059
Kitaev-Smyk, L.
[A CAT FLOATS IN THE AIR] V vozdukhe parit ... koshka.—Nauka i zhizn' (Moskva), 30 (4): 35-39. April 1963. In Russian.

A popular exposition is presented of reactions to weightlessness by animals during parabolic flight in aircraft. The article is illustrated by photographs showing reaction to weightlessness of cats, pigeons, fish, rabbits, and mice.

1060
Konecci, E. B.,
and C. B. S. Evans
GRAVITY DESIGN REQUIREMENTS FOR SPACE STATIONS.—Proceedings of the Lunar and Planetary Exploration Colloquim, 3 (2): 135-140. May 5, 1963.

Future manned space systems currently in the design phase must focus on the requirements of the astronaut. Inconclusive physiological evidence suggests that man may experience diminshed tolerance to supergravity loads, following prolonged exposure to subgravity or weightlessness. Conditioning for the supergravity state could be sustained by: (a) linearly accelerating the vehicle continuously during the journey, (b) rotating the vehicle, or (c) stopping off at rotating way-stations. The advantages, disadvantages, and feasibility of each method are discussed. Included are representative figures. (Authors' abstract)

1061
Lansberg, M. P.
SOME CONSEQUENCES OF WEIGHTLESSNESS AND ARTIFICIAL WEIGHT.—In: Space research and technology, p. 7-10. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962

Some of the physiological consequences of weightlessness are discussed. Artificial ventilation of the space cabin is necessary, because of the absence of convection. In the absence of gravitational clues to position, some disorientation may occur and motor activities may have to be relearned, but muscular atrophy is not likely to be a real hazard. It would be unwise to extrapolate from what is experienced during parabolic flights to what can be expected during semipermanent weightlessness. Problems raised by rotation of the space vehicle to produce artificial "weight" are also considered, and it is shown that von Braun's proposal for the rotation of a 40 meter-radius staellite at an angular velocity of 2/7 radian per second is not fully satisfactory. (Author's abstract)

1062
Loftus, J. P.,
and L. R. Hammer
WEIGHTLESSNESS.—In: Unusual environments and human behavior, p. 353-377. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

A description is given of the three techniques most commonly used to produce or simulate weightlessness: parabolic maneuvers in aircraft, frictionless platforms, and water immersion, and the effects on physiological function and behavior are analyzed. After considering the problems of orientation, psychomotor performance, and various physiological functions, the authors conclude that man can function effectively in a weightless environment. The conclusion is supported by the results of manned orbital flights, but the study of long exposures to the weightless condition are needed. (49 references)

1063
McCally, M.,
and R. W. Lawton
THE PATHOPHYSIOLOGY OF DISUSE AND THE PROBLEM OF PROLONGED WEIGHTLESSNESS: A REVIEW.—Aerospace Medical Division. Biomedical Labs., Aerospace Medical Research Lab. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722201). Technical Documentary Report no. AMRL-TDR-63-3, June 1963. iv+46 p.

The physiological implications of zero-g as encountered in space flight are discussed and the available research concerning the physiological effects of weightlessness is reviewed. The purpose of this review is to proceed from the present state of knowledge of normal human physiological systems, particularly as their structure and function are affected by gravity, to a consideration of the possible physiological consequences of prolonged human exposure to zero-g. Methods used to produce and simulate zero-g are briefly reviewed. The data suggesting that prolonged weightlessness will be a deconditioning environment is presented. These data are considered for possible untoward effects of prolonged exposure to weightlessness, and for methods of prevention of undesired effects. The problem of artificial gravity by rotation of a space vehicle is briefly considered. Areas of needed future investigation are suggested. (Author's abstract) (169 references)

1064
McCally, M.,
and D. E. Graveline
URINARY CATECHOLAMINE RESPONSE TO WATER IMMERSION.—Aerospace Medical Division. Biophysics Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722201). Technical Documentary Report No. AMRL-TDR-63-20, March 1963. iii+10 p.

The urinary excretion of adrenaline and noradrenaline was measured by bioassay for 16 normal human subjects during 6 hours of complete water immersion. The excretion of adrenaline was moderately increased, possibly related to the anxiety associated with the immersion. The excretion of noradrenaline was significantly ($p<0.01$) reduced during immersion. Six subjects were studied during passive vertical tilt following immersion. Orthostatic intolerance was demonstrated, and the increase in pulse rate and decrease in pulse pressure were significantly different from the control tilt. The probable mechanisms of the reduced noradrenaline excretion during immersion and its relation to the postimmersion impairment of orthostatic tolerance are discussed. (Authors' abstract)

1065
Margaria, R.,
and T. Gualtierotti
[PERCEPTION OF MOTION, EQUILIBRIUM, AND ORIENTATION IN CONDITIONS OF ZERO GRAVITY] La percezione del moto, l'equilibrio e l'orientamento in condizioni di gravitazione nulla.—Rivista di medicina aeronautica e spaziale (Roma), 25 (3): 450-465. July-Sept. 1962. In Italian, with English summary (p. 462).

The main systems (vestibular and visual systems and cutaneous exteroceptors) controlling body sensations in space are reviewed. All converge at the level of the cerebellar cortex which analyzes accelerations via labyrinthine connections and integrates visual, acoustic, and other data. The mechanism of action of vestibular receptors is discussed in relation to their anatomical position and to the constant stimulus of 1 g. Gravity receptors appear to follow the Weber-Fechner law, that for a sensation to increase by equal amounts (arithmetical progression), the stimulus must increase by geometrical progression. A hypothesis is presented that under zero gravity conditions responses to a given acceleration will be greater than when sense organs are already subjected to a constant stimulus of 1 g. It is also postulated that the otoliths work as a differential inertia meter. Experimental verification of these hypotheses is suggested by means of comparing the response to acceleration on Earth and during orbital flight in the same animal.

1066
Meineri, G.
[THE EFFECTS OF SUBGRAVITY AND THE METHODS FOR REPRODUCING IT ON THE GROUND AND IN FLIGHT] Gli effetti della subgravità e i metodi per riprodurla a terra e in volo.—Rivista di medicina aeronautica e spaziale (Roma), 26 (1): 80-98. Jan.-March 1963. In Italian, with English summary (p. 94).

A review of the literature is presented which deals with experiments on the physiological effects of subgravity. The chief methods used to simulate subgravity conditions are described and a distinction is made between ground methods (immersion of all or part of the body in water, high acceleration exposure), and the more cumbersome methods through which actual or complete subgravity can be attained (parabolic flight, suborbital and orbital launching). The accomplishments are reported of the Center of Studies and Researches in Aerospace Medicine, Rome, which uses a subgravity tower for experiments. This tower is of great value in obtaining data on the physiological effects of short-term subgravity similar to that encountered in space flight, such as transition between the active and passive stage of flight, the effects on psychomotor behavior, the role played by the labyrinth and its components, etc. The possible extension of these methods into worldwide space research projects is discussed. (33 references)

1067
Mueller, D. D.,
and J. C. Simons
WEIGHTLESS MAN: SINGLE-IMPULSE TRAJECTORIES FOR ORBITAL WORKERS. — Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-62-103, Sept. 1962. iii+9 p.

While performing maintenance and assembly tasks outside of space vehicles under weightless conditions, a worker may accidentally propel himself away from his vehicle. To determine the speed of such a single-impulse launch, subjects under weightless conditions in a zero-g KC-135 aircraft propelled themselves away from a surface with their legs. They attained maximum velocities of approximately 10 m.p.h. Using various launch speeds and directions, theoretical trajectories were projected for both coplanar and noncoplanar launches. These trajectories indicate that any launch having a velocity component parallel to the direction of orbital motion will result in a trajectory such that the worker will never return to his vehicle. (Authors' abstract)

1068
Neifakh, A.
[SPACE EMBRYOLOGY] Kosmicheskaia embriologiia.—Nauka i zhizn' (Moskva), 30 (1): 65-67. Jan. 1963. In Russian.

The author suggests that space research offers unique possibilities for the study of fundamental questions of embryology. The existing opportunities to expose biological objects to zero gravity for prolonged periods could be used to elucidate the origin of bilateral symmetry during embryogensis. No original research data are included.

1069
Neuman, W. F.
POSSIBLE EFFECTS OF WEIGHTLESSNESS ON CALCIUM METABOLISM IN MAN. — Univ. of Rochester. Atomic Energy Project, New York (Contract W-7401-eng-49). Report no. UR-622, Jan. 18, 1963. [15] p.

In the Man in Space Program, manned flights of two weeks' duration are projected for the immediate future. Such periods of immobilization under gravity-free conditions are likely to produce mobilization of skeletal calcium, hypercalcemia, and hypercalcuria. Data on fracture-patients, polio-patients, and immobilized normal "volunteers" are reviewed to provide a basis for a tentative evaluation of the immediate problem and to delineate those data needed for an evaluation of the problem in more protracted flights scheduled for the more distant future. (Author's abstract)

1070
Nixon, C. W.,
and C. E. Waggoner
SPEECH DURING WEIGHTLESSNESS. — Aerospace Medical Division. Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 723103). Technical Documentary Report no. MRL-TDR-62-45, May 1962. iii+10 p.

Standard speech materials were recorded on magnetic tape by eight subjects (six Project Mercury Astronauts who had previous zero-gravity experience and two other subjects who had no previous zero-gravity experience) under 0 g, 1 g, and 2 1/2 g's during parabolic flight of the KC-135 aircraft. Subjects were also queried concerning their personal reactions to speech under the altered g conditions. The recorded speech materials were evaluated by both subjective and objective methods. No differences were observed among the responses of the zero-g oriented astronauts and the non-oriented subjects. Speech production and reception are not significantly altered by brief periods of zero gravity. Both speakers and listeners indicate good speech intelligibility under weightlessness. (From the authors' summary and conclusions)

1071
Roman, J. A.,
B. H. Warren, J. I. Niven, and A. Graybiel
SOME OBSERVATIONS ON THE BEHAVIOR OF A VISUAL TARGET AND A VISUAL AFTER-IMAGE DURING PARABOLIC FLIGHT MANEUVERS. — School of Aerospace Medicine, Brooks Air Force Base, Tex. (AFSC Project no. 7930), and Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1, Report no. 64). Report no. SAM-TDR-62-66, June 1962. 8 p.

The apparent displacement of a real target and a visual afterimage were observed in the F-100F aircraft during periods of weightlessness averaging 45 seconds. The experimental results are used as a background from which to reconcile apparent discrepancies between the findings of different investigators. The cause of these differences was found to lie in the opposing directions of illusory movements when real objects and visual after-images were observed. (Authors' abstract, in part)

1072
Roman, J. A.,
B. H. Warren, and A. Graybiel
THE SENSITIVITY TO STIMULATION OF THE SEMICIRCULAR CANALS DURING WEIGHTLESSNESS.—School of Aerospace Medicine, Brooks Air Force Base, Tex. and Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Task no. 793002, Subtask 1). Technical Documentary Report no. SAM-TDR-62-148, Feb. 1963. iii+8 p.

Also published as: Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1), and School of Aerospace Medicine, Brooks Air Force Base, Tex. Report no. 84, May 20, 1963. iii+8 p.

The sensitivity to stimulation of the semicircular canals during periods of weightlessness averaging 46 seconds was estimated by timing the duration of apparent rotation of a visual target and of the subject's perception of rotation after stimulation. Stimulation was accomplished by rolling the aircraft during periods of subgravity as well as during 1-g control maneuvers. Time-intensity relationships of the stimulus were obtained by means of specialized instrumentation incorporated into the experimental subject's crash helmet. No quantitative difference was established between the subgravity maneuver and the 1-g control maneuver as regards response to stimulation of the semicircular canals. (Authors' abstract, in part)

1073
Simons, J. C.,
and M. S. Gardner
WEIGHTLESS MAN: A SURVEY OF SENSATIONS AND PERFORMANCE WHILE FREE-FLOATING.—Aerospace Medical Division. Behavioral Sciences Lab., Aerosapce Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405), Technical Documentary Report no. AMRL-TDR-62-114, March 1963. vii+65 p.

The effect of surface-free behavior on work performance in space was investigated to determine what techniques should be developed to aid the orbital workers. While they performed gross motor activities under weightless conditions, subjects reported their sensory and performance experiences during Keplerian parabolas in a C-131B aircraft in both lighted and dark cabin conditions. Their experiences were categorized into sensation influences upon orientation and body motion influences upon body attitude and position control. Unique examples of short-term weightless behaviors were found and their causes are briefly discussed. Potential applications of these weightless responses to hardware development and to crew training and selection are discussed, and significant areas for future research are proposed. (Authors' abstract) (39 references)

1074
Uganov, E. M.,
I. I. Kasian, and M. A. Cherepahin
SENSORY REACTIONS AND THE STATE OF SOME MOTOR INDICES OF MAN UNDER WEIGHTLESSNESS.—Revue de médecine aéronautique (Paris), 1 (3): 12-14. March-April 1962. In English.

Studies were conducted on 54 persons between 22 and 43 years of age during a weightless state for 35-45 seconds. Analysis of the obtained data showed that all persons could be divided into three groups according to the nature and the degree of expression of sensory reactions. Group I (26 people) endured weightlessness without noticeable deterioration of body function. Group II (18 people) experienced and expressed the feeling of dropping head-down, of rotation of the body in uncertain directions, etc.; this group after experiencing the state of weightlessness 12-15 times became completely adapted to the effects. Group III (10 people) developed unpleasant phenomena rapidly terminated by symptoms of seasickness (nausea, vomiting) which resulted in temporary disability. Cinematography of 14 persons performing muscular tasks during the weightless state revealed that the accuracy of operation in the majority of cases was considerably altered.

1075
Wade, J. E.
PSYCHOMOTOR PERFORMANCE UNDER CONDITIONS OF WEIGHTLESSNESS. — Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. MRL-TDR-62-73, June 1962. iii+7 p.

Subjects operated three different sets of switches as they were flown through 0-g trajectories in a C-131B aircraft. Push-button, toggle, and rotary switches were each paired with a master push-button switch to form the three sets used to turn an indicator light on and off. The subjects were instructed to perform the task as fast as possible by alternate actuation of the two switches of each set. Each subject also performed in straight and level flight with each set of switches for control data. Performance data, along with aircraft accelerative forces in three dimensions, were recorded on a high-speed oscillograph. Small but statistically significant decrements were found in speed of operation of all three sets of switches in the 0-g environment in comparison with performance at 1 g. The toggle switch set showed the greatest decrement, the rotary switch set the least decrement. The push-button switch set was operated most rapidly in both 1-g and 0-g conditions. (Author's abstract)

d. Barometric Pressure (Altitude)

[*Altitude suits under 10b; Altitude sickness under 8-b*]

1076
Anand, S. P.
SOME HUMAN PROBLEMS OF HIGH ALTITUDE.—Jour. United Service Institution of India (New Delhi), 92 (389): 321-324. Oct.-Dec. 1962.

A discussion is presented of some of the problems facing the Indian Army operating at 14,000 feet and above in the Himalayas. These difficulties of high-altitude living include behaviorial problems of the troops, the effects of cold, and medical service problems such as helicopter evacuation of the sick.

1077
Arias-Stella, J.,
and S. Recavarren
RIGHT VENTRICULAR HYPERTROPHY IN NATIVE CHILDREN LIVING AT HIGH ALTITUDE. — Amer. Jour. Pathol., 41 (1): 55-64. July 1962.

The ratio of left and right ventricular weights (Hermann-Wilson index) was investigated in 70 infants and children born and living at sea level and in 59 like subjects from high altitudes (12,225 to 14,300 feet). In both, the cases were divided into 4 groups according to age: newborn or stillborn; 1 day to 3 months; 4 to 23 months; and 2 to 10 years. It was shown that at sea level the Hermann-Wilson index attained values corresponding to those characteristic of adults, beginning at the fourth month of life. In the high-altitude group the ratio indicated a persistent right ventricular predominance; normally present at birth, this ordinarily gives way in due course at sea level to left ventricular dominance. The apparent right ventricular hypertrophy persisted from the fourth month of life up to the maximum age investigated (10 years). It was also observed that the degree of right ventricular predominance at birth and up to age 3 months was greater in the infants born at high altitudes. (Authors' conclusions)

1078
Badger, D. W.,
and N. Pace
BLOOD VOLUME CHANGES IN DOGS EXPOSED TO ALTITUDE [Abstract]. — Physiologist, 5 (3): 101. Aug. 1962.

Changes in red cell mass, plasma and total blood volumes were compared in intact and splenectomized dogs sojourning at 12,470 feet altitude. Similar measurements were made in splenectomized dogs, whose aortic and carotid chemoreceptors had been ablated (glomectomized) to prevent respiratory response to hypoxia. All groups showed increased red cell mass. The intact and splenectomized dogs reached 145% of sea level values, the latter more slowly. The glomectomized-splenectomized dogs increased to 250%, hematocrit values as high as 86% being observed. Plasma volume decreased within a few days in all groups, the intact dogs fell to 90% of sea level and returned by 60 days, the splenectomized decreased to 70% and recovered by 240 days, while the glomectomized decreased to 50% and had not recovered by 500 days. The erythropoietic response to hypoxia is slow in splenectomized dogs, although the same degree of increase in red cell mass as in intact dogs occurs eventually. On the other hand, the glomectomized-splenectomized dogs showed a far greater erythropoietic response to hypoxia than the other groups. It is apparent that the chemoreceptors are not needed for the erythropoietic response, but that the spleen may play a role in erythropoiesis. Further, in the absence of hypoxic hyperventilation mediated by the glomi, the erythropoietic response is enhanced, with or without the presence of the spleen. Finally, the early decrease in plasma volume may be accounted for, at least in part, by activation of left atrial stretch receptors by hypoxia-induced increased pulmonary venous pressure, with resultant decrease in ADH secretion. (Authors' abstract)

1079
Baird, B.,
and S. F. Cook
HYPOXIA AND REPRODUCTION IN SWISS MICE. — Amer. Jour. Physiol., 202 (4): 611-615. April 1962.

Mice were maintained in closed decompression chambers: (1) continuously at simulated altitudes of 14,200 and 18,000 feet; (2) intermittently, 6 hr/day, at 20,000, 21,500, and 25,000 feet; and (3) continuously at sea level with atmosphere of 12% oxygen and 88% nitrogen. All animals were acclimatized before exposure. In all cases mating behavior was normal, and there was no functional impairment of male fertility. Impregnation was observed with all mated, adapted females in almost all experiments. Exceptions were considered due to early resorption of embryos. No significant effect of hypoxia was noted on implantation, placentas, vascularization, gestation time, or parturition. Adverse effects of hypoxia were manifested primarily in resorption of fetuses when they had attained a critical size (about 7 mm.). The incidence of resorption is correlated directly with stress level, expressed as duration and intensity of hypoxia, and is considered to be contingent on the critically respiring mass of fetal tissue. (Authors' abstract)

1080
Barabashova, Z. I.
[CORRELATION BETWEEN RESISTANCE OF THE ORGANISM AND OSMOTIC RESISTANCE OF THE ERYTHROCYTES] O korreliatsii mezhdu rezistentnost'iu organizma i osmoticheskoi rezistentnost'iu eritrotsitov.—Fiziologicheskii zhurnal SSSR (Moskva), 49 (5): 626-631. May 1963. In Russian.

Rats were initially exposed to a simulated altitude of 2500 m. and 12 days later to 7600 m. for 4 hours daily. After termination of a 30-day conditioning period, the animals were tested for acclimatization to hypoxia by exposure to an altitude of 13,000 m. for 5-minute periods. Blood samples of rats with high hypoxia tolerance were tested to determine the osmotic resistance of the erythrocytes. Erythrocytic hemolysis in a hypotonic solution of NaCl occurred in 25% of the cells of adapted rats, compared to 50% of the cells of controls. Further hemolytic tests in solutions of different hypotonicity showed that hemolysis of the erythrocytes of hypoxia-adapted animals proceeded more slowly than that of control samples.

1081
Barer, A. S.,
and E. V. Iakovleva
[CHANGES IN THE CONCENTRATION OF SODIUM AND POTASSIUM IONS IN THE HUMAN URINE AND SALIVA DURING "ASCENTS" IN A BAROCHAMBER TO 5000 M. AND 6000 M. ALTITUDES] Izmenenie soderzhaniia ionov natriia i kaliia v moche i sliune cheloveka pri "pod"emakh" v barokamere na vysotu 5000 i 6000 m. — Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 53 (1): 63-65. Jan. 1962. In Russian, with English summary (p. 65).

Salivary and urinary sodium and potassium concentrations were studied by flame photometry in a group of 26 men at 5000 m. simulated altitude (30 min.), and a group of 24 men at 6000 m. simulated altitude (15 min.). Samples of urine and saliva were obtained before, during, and after the stay in the barochamber. Regular shifts were seen in the Na and K concentrations and the Na/K ratio. The concentration of K ions had a tendency to rise, while that of Na dropped. With repeated ascents the shifts became smoother.

1082
Berendsohn, S.
HEPATIC FUNCTION AT HIGH ALTITUDES. — Arch. Internal Med., 109 (3): 256-264. March 1962.

Tests of liver function were conducted in 30 subjects born and resident at sea level and in 30 subjects born and resident at an altitude of 14,900 feet. Blood analyses showed a significant increase in indirect bilirubin in high-altitude subjects, while direct bilirubin was within normal limits. The indirect hyperbilirubinemia at altitude is attributed to a defect in the hepatic conjugation mechanism for biliary excretion, resulting from anoxemia or polycythemia. Total serum protein was normal at altitude, but the albumin/globulin ratio was decreased as a result of an increase in globulins. Retention of injected sulfobromophthalein dye was normal in most high-altitude subjects, but was increased in some subjects with hyperbilirubinemia. Inorganic phosphrous tended to be increased in high-altitude subjects, and alkaline phosphatase activity was increased. Flocculation tests for zinc, thymol, and cephalin-cholesterol were normal, indicating a normal state of protein equilibrium. The behavior of glutamic-oxaloacetic and glutamic-pyruvic transaminases was also normal in high altitude subjects. It is concluded that high altitude does not produce major alterations in the function of the hepatic cells.

1083
Berry, L. J.,
and D. S. Smythe
EFFECT OF PURE OXYGEN AT REDUCED PRESSURES ON METABOLIC CHANGES IN MICE. — Amer. Jour. Physiol., 203 (1): 155-159. July 1962.

The gravimetric "equivalence" between protein catabolized and carbohydrate synthesized in response to cortisone was determined in mice exposed for periods of 3 weeks to air at simulated 14,000-feet or 20,000-ft. altitude or to pure oxygen at simulated 30,000-ft. or 34,000-ft. altitude. For control mice and those exposed to pure oxygen at 30,000 ft. and 34,000 ft. equivalence was, respectively, 92%, 90%, and 98%. Animals on air at 14,000 ft. and at 20,000 ft. had, respectively, 46% and 37% equivalence. In all mice, protein catabolism was the same, statistically, but carbohydrate synthesis varied. Mice exposed to air at 14,000 ft. or 20,000 ft. show 35% and 46% survival after a dose of endotoxin survived by 84% of control animals and 86% of those kept for 3 weeks on pure oxygen at simulated 34,000 ft. Other effects of low barometric pressure are described. (Authors' abstract)

1084
Billings, C. E.,
P. K. Johnson, G. N. Hoover, and D. K. Mathews
THE EFFECT OF MODERATE ALTITUDE ON EXERCISE [Abstract]. — Physiologist, 5 (3): 107. Aug. 1962.

This report describes controlled studies in an altitude chamber at 720, 620, and 520 mm. Hg barometric pressures (1,500, 5,500, and 10,200 feet pressure altitudes). Eleven male athletes performed mild work (4 times the resting oxygen uptake) twice at each altitude under identical conditions. The experiment was carried out under double blind precautions. Expired air samples were collected; ventilation, oxygen uptake and carbon dioxide output were determined. It was found that the excess oxygen cost of this mild work was not significantly increased at either 620 or 520 mm. Hg compared with 720 mm. Hg. Minute ventilation during exercise, however, increased incrementally and significantly as barometric pressure was reduced. Increases in respiratory frequency at altitude may explain why no significant difference was observed in respiratory exchange ratios with increasing altitude. This study and others in the literature suggest that a "time-dose" relationship exists for aerobic muscular work performed breathing ambient air at pressure altitudes as low as 5,500 feet. (Authors' abstract)

1085
Bowen, I. G.,
and A. Holladay
A FLUID-MECHANICAL MODEL OF THE LUNG FOR STUDIES IN BLAST BIOLOGY. — In: Proceedings of the San Diego symposium for biomedical engineering, vol. 2: 142-149. 1962.

A mathematical model of the lung was conceived to help explain the direct effects of an overpressure pulse on mammals in terms of the fluid-mechanical response of the thoraco-abdominal structures. The differential equations defining the model were solved numerically to obtain the pressure in the simulated lung as a function of time for a given forcing function, viz., blast wave. The pressures predicted by the model were found to correspond reasonably well with those recorded in lungs and thorax of test animals subjected to a blast overpressure. Equations were derived relating each of the parameters of the model to animal body mass so that the model might be used to simulate the blast response of an idealized animal of arbitrary mass. An application of the model to the problem of step-wise pressure loading was made. (Authors' abstract)

1086
Brüner, H.,
K. E. Klein, and D. Jovy
MODIFICATION OF THE INDIVIDUAL STRESS-SENSITIVITY BY ADAPTATION TO OXYGEN-WANT IN THE LOW-PRESSURE CHAMBER.—In: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 16-27. Oct. 1963. In English and German.

The authors tested whether the property of a person to respond to a definite and unspecific stress by adreno-cortical reaction is modified by chronic exposure to oxygen deficiency. They found that it is possible to improve the altitude tolerance by an intermittent oxygen-want exposure (total pressure of 353.6 Torr equal to 6000 m. altitude) of 30 minutes daily for four weeks. At the end of that period there were only small changes in respiration, circulation, erythrocytes, and hemoglobin. A simultaneous strong decrease in the adreno-cortical reaction was considered as a decrease in stress sensitivity.

1087
Bulatova, N. N.
[CHARACTERISTICS OF THE BLOOD OF HIGH-ALTITUDE ANIMALS] Osobennosti krovi vysokogornykh zhivotnykh.—Trudy Instituta morfologii zhivotnykh im. A. N. Severtsova, Akademiia nauk SSSR (Moskva), 41: 11-46. 1962. In Russian.

The blood indices of high-altitude animals (mountain goats) differed from those of animals living at normal elevations as follows: high-altitude animals showed an increased hemoglobin ratio and an elevated erythrocyte count (including many microcytes). As a rule, the hemoglobin content of the erythrocytes was 40% higher. Exposure of normal animals to high altitudes resulted in an increased erythrocyte count without a parallel increase of cellular hemoglobin content. The paper contains 31 tables giving hematological data for a variety of animals under different environmental conditions. (108 references)

1088
Chambers, V. V.,
M. R. Allansmith, and H. J. Simon
EFFECT OF A SIMULATED ALTITUDE CHANGE ON ASTHMA. — Annals of Allergy, 20 (10): 666-668. Oct. 1962.

A six-hour exposure to a simulated altitude of 8000 feet in a pressure chamber had no effect on 14 asthmatics. No changes in clinical status were discovered immediately or during the four weeks following the pressure change.

1089
Chiodi, H.
OXYGEN AFFINITY OF THE HEMOGLOBIN OF HIGH ALTITUDE MAMMALS.—Acta physiologica latino americana (Buenos Aires), 12 (2): 208-209. 1962. In English.

The oxyhemoglobin dissociation curve of the pooled blood of two chinchillas (Chinchilla brevicaudata, a native high-altitude rodent) was determined. The half saturation point corresponded to an oxygen tension (pO_2) of 24 mm. Hg, compared to a pO_2 of 34 mm. Hg in the rabbit, and 18 mm. Hg in the alpaca (Lama paco). These findings agree with those of Hall, Dill, and Guzman Barron (1936) who studied the high-altitude camelids, the vicuña and llama, and two species of birds, the huallata or Bolivian goose and the South American ostrich. High-altitude representatives of the species studied thus far have a blood hemoglobin with a greater affinity for oxygen than that of their sea level relatives. Included is a table listing the oxygen affinity of equilibrated blood of chinchilla, rabbit, and alpaca.

1090
Clemedson, C.-J.
SOME BLAST STUDIES WITH APPLICATIONS TO EXPLOSIVE DECOMPRESSION.—In: Space research and technology, p. 1-7. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

The similarities and dissimilarities between explosive decompression and blast injury are discussed. The qualitative changes in respiration and circulation, as well as the pathological changes in the lungs, are the same in these two kinds of trauma. The reflex mechanism mediating the physiological changes may differ, however, and in blast a direct mechanical effect on the heart seems to play a greater role than in explosive decompression. The bio-mechanical events which result in the pathological and pathophysiological changes are supposed to differ in the two conditions, but more research is necessary in order to verify the assumption. (Author's abstract)

1091
Curtis, J. L.
VISUAL PROBLEMS OF HIGH ALTITUDE FLIGHT. — In: Visual problems in aviation medicine, p. 39-44. Ed. by A. Mercier. Oxford: Pergamon Press, 1962.

Visual problems inherent in high-performance aircraft flying at high altitude are glare, cockpit haze, space myopia, and the visual restrictions induced by wearing high-altitude helmets. Space myopia with the resultant loss of visual effectiveness, especially in the field of air-to-air search, is considered the most serious. Ultraviolet light once considered a visual hazard has been shown to be of no particular significance unless flying above 120,000 ft. where the ozone layers render it more dangerous. Lens fluorescence has been eliminated as a visual problem at presently attainable altitudes in operational type aircraft.

1092
DeBias, D. A.
HORMONAL FACTORS IN THE RAT'S TOLERANCE TO ALTITUDE. — Amer. Jour. Physiol., 203 (5): 818-820. Nov. 1962.

The survival period of adrenalectomized rats, which are less tolerant than normal rats to reduced barometric pressure (equivalent to altitude of 27,800 feet), can be extended when the animals are pretreated with adequate amounts of cortisol. Pretreatment of adrenalectomized animals with somatotropin (0.5 mg./100 g. body wt.) did not have any significant effect on tolerance to simulated altitude, but when somatotropin was administered simultaneously with a subeffective dose of cortisol, tolerance to altitude was significantly increased. Thyroidectomy did not have a beneficial effect on survival of adrenalectomized animals, but pretreatment of adrenalectomized-thyroidectomized rats with 3 mg. cortisol, which is inadequate to protect the adrenalectomized animal against exposure to simulated altitude, significantly increased survival rate. A possible mechanism whereby lesser amounts of cortisol are effective in prolonging survival of thyroidectomized-adrenalectomized rats exposed to low barometric pressure may be a decrease in catabolism of the steroid in hypothyroid animals. (Author's abstract)

1093
Dejours, P.,
R. H. Kellogg, and N. Pace
REGULATION OF RESPIRATION AND HEART RATE RESPONSE IN EXERCISE DURING ALTITUDE ACCLIMATIZATION. — Jour. Applied Physiol., 18 (1): 10-18. Jan. 1963.

In three subjects pulmonary ventilation, alveolar gas, blood lactate, and heart rate were studied at rest and during two grades of treadmill exercise in four environmental conditions: at sea level breathing air or 13% O_2 (simulating altitude), and during a sojourn of 3 weeks at an altitude of 3,800 m. breathing air or 33% O_2 (simulating sea level). At altitude, ventilatory response to exercise was decreased by inhalation of 33% oxygen but remained above that observed at sea level breathing air. Study of the transients at the beginning and end of exercise showed that in all four environmental conditions, the ventilatory response to exercise could be dissected into fast and slow components, interpreted as neurogenic and humoral, respectively, in accordance with the neurohumoral theory. In two subjects, the increased hyperpnea of exercise at altitude represented increases in both the neurogenic and humoral components, while in the third subject only the humoral component was increased. Study of the composition of alveolar gas at the start and end of exercise indicated that pulmonary blood flow as well as ventilation undergoes immediate change at these times. Resting blood lactate concentrations and the increment produced by exercise were higher at altitude, and resting heart rate tended to increase throughout the altitude sojourn in these subjects. The increment in pulse rate produced by exercise fell progressively, as expected. (Authors' abstract)

1094
Edman, C. D.,
N. P. Silvers, E. C. Gangloff, and R. F. Krause
CREATINE, CREATINE PHOSPHATE, AND CREATININE LEVELS IN HYPOXIA HYPERTROPHIED RAT HEARTS.—Amer. Jour. Physiol., 204 (6): 1005-1007. June 1963.

Cardiac hypertrophy was produced in adult, male, albino rats by prolonged exposure to reduced atmospheric pressure. Creatine, creatine phosphate, and creatinine levels in these hypertrophied hearts were all significantly reduced from those of control rats. (Authors' abstract)

1095
Fujihara, H.
[THE EFFECT OF LOW-PRESSURE LOAD UPON THE HUMAN BODY, ESPECIALLY ON HEMATOLOGICAL INDICATORS] [Abstract]. — In: Abstracts of the 7th Meeting of the National Defense Medical Society. Bōei Eisei (National Defense Medical Journal) (Tokyo), 9 (3): 103-104. March 1962. In Japanese.

Seven healthy men, 42 male rabbits, and 5 goats were exposed to altitudes of 0-13 kilometers for periods of 2-3 hours or (in the case of the goats) until they died. In the men there was a slight increase in the red and white blood cell count, as well as an increase in the total serum protein value. The hematocrit value remained normal. The results found in the rabbits generally followed that of the humans. In the goats, the number of red and white blood cells decreased while the amount of hemoglobin increased. The number of eosinophils is slightly increased as well as the total specific gravity of the blood. Above 9 kilometers, organs suffered from blood congestion, and hemorrhages were found in the heart of the autopsied animals.

1096
Furry, D. E.
TOLERANCE OF MICE X-IRRADIATED IN AN OXYGEN RICH ENVIRONMENT TO THE STRESS OF EXPLOSIVE DECOMPRESSION.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-1002, Subtask 17). Report no. 4, Feb. 25, 1963. ii+7 p.

Male Swiss albino mice exposed to 700 r whole-body X-irradiation while breathing either air or 100 per cent oxygen were explosively decompressed from sea level to a terminal altitude of 30,000 feet within one hour following irradiation. A second group of mice exposed to X-irradiation only while in an air or oxygen rich environment was maintained for a 30-day observation period. On the basis of pooled survival data it is concluded that the use of either an air or oxygen-rich environment during exposure to X-irradiation has no effect on the tolerance of mice to explosive decompression as evidenced by immediate survival or 30-day survival. The expected 30-day survival proportion of mice exposed to whole-body X-irradiation only while breathing oxygen is significantly reduced when compared to the survival proportion of mice breathing air. (Authors' abstract)

1097
Gabl, F.,
and M. J. Halhuber
[ADRENOCORTICAL ACTIVITY IN HIGH MOUNTAIN CLIMATE] Nebennierenrindenaktivität im Hochgebirgsklima. — Wiener Zeitschrift für innere Medizin (Wien/Innsbruck), 43 (5): 217-222. May 1962. In German.

Observation of urinary cortisone excretion and the red blood count in studies conducted with five subjects during four weeks in a high-mountain resort at 2000 m. altitude (Obergurgl) showed a statistically significant increase of the adrenal cortex activity in the first week, which receded in the second week, followed by marked fluctuations in the third week, after which in the fourth week it finally returned to the initial values (preliminary values obtained at sea level). These results are in agreement with the findings from investigations of different organs and systems, which leads to the conclusion that there is a nonspecific adaptation process which subsides only in the fourth week after proceeding on a stepwise course.

1098
Gill, M. B.,
J. S. Milledge, L. G. C. E. Pugh, and J. B. West
ALVEOLAR GAS COMPOSITION AT 21,000 TO 25,700 FT. (6400-7830 M). — Jour. Physiol. (London), 163 (3): 373-377. Oct. 1962.

During the recent Himalayan expedition alveolar gas samples were collected by the Haldane-Priestley technique at altitudes of 21,000 ft. (6400 m.), 24,400 ft. (7400 m.), and 25,700 ft. (7830 m.) where the barometric pressures were 344, 300, and 288 mm. Hg, respectively. The mean alveolar carbon dioxide tensions at the three altitudes were 20.7, 15.8 and 14.3 mm. Hg, respectively; the mean alveolar oxygen tensions were 38.1, 33.7 and 32.8 mm. Hg, respectively. By plotting the alveolar gas points on an O_2, CO_2 diagram, it is shown that they lie between the lines drawn by Rahn and Otis (1949) giving the alveolar gas compositions of men acutely exposed to low pressures and of men acclimatized to high altitudes. These results are consistent with the altitude history of the subjects, and agree well with the curve predicted from data previously collected on Mount Everest. (Authors' abstract)

1099
Grover, R. F.,
J. T. Reeves, D. H. Will, and S. G. Blount
PULMONARY VASOCONSTRICTION IN STEERS AT HIGH ALTITUDE.—Jour. Applied Physiol., 18 (3): 567-574. May 1963.

Each of ten steers taken for 9 weeks to 12,700 ft. (Mt. Evans, Colorado) showed a marked increase in pulmonary artery (PA) pressure. Three animals had PA pressures above 90 mm. Hg and one developed right heart failure. The bovine species is remarkable for the severe pulmonary hypertension which develops during chronic hypoxia rather than for an excessive PA pressure response to acute hypoxia. The rate at which the pulmonary hypertension developed at 12,700 ft. was extremely rapid compared to that at 10,000 ft. Therefore, not only the duration of the hypoxic stimulus but also its severity determine the response. The severity of the stimulus was augmented by the absence of a sustained increase in ventilation at high altitude. The pressure rise with acute hypoxia during the control period at low altitude and the dramatic fall in PA pressure when oxygen was administered at high altitude provided evidence for hypoxia-induced pulmonary vasoconstriction as an important mechanism in bovine pulmonary hypertension. (Authors' abstract)

1100
Haduch, S.
CERTAIN PHYSIOLOGICAL ASPECTS OF PRESSURE BREATHING.—Revue de médecine aéronautique (Paris), 1 (2): 159-161. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (1): 17-18. Jan. 1963.

Investigations were performed on 14 rabbits in a decompression chamber subjected to simulated altitudes of up to 15,000 m. and on 20 pilots breathing pure oxygen for 60 minutes and then elevated to a simulated altitude of 15,000 m. with simultaneous pressure breathing. The results indicate that: (1) as altitude is gained, respiratory frequency increases with simultaneous decrease in respiratory depth; (2) pressure breathing at altitude causes a marked drop in arterial blood pressure and an increase of venous blood pressure; (3) changes in respiratory and circulatory functions are transitory; and (4) blood oximetry alone does not constitute a satisfactory means for evaluation of physiologic efficiency at altitude. Simultaneous examination of respiratory frequency, measurement of the duration of respiratory phases, and oxygen blood saturation is needed.

1101
Hartmann, H.,
and K. G. Müller
[MECHANICAL STRESS OF THE LUNGS IN DECOMPRESSION] Mechanische Belastung der Lunge beim Druckfall. —— Zeitschrift für Flugwissenschaften (Braunschweig), 10 (4/5): 203-216. April/May 1962. In German, with English summary (p. 203).

During atmospheric decompression air bubbles may be liberated in the blood and tissues. These are considered to be caused by two factors: (1) a solubility component due to release of the dissolved gas, and (2) a lung component due to air permeating the lung. In order to investigate the lung component, the mechanical properties of the lung are summarized. Based on the concept of a mechanical model, an equivalent electrical circuit of the entire system lung-thorax-abdomen is developed. In this circuit, it is possible to study the dynamic behavior of the lung and evaluate the relative effects of various stresses. The over-expansion of the alveoli is considered to be the actual cause of the lung component. The critical threshold for over-expansion is discussed together with experiments relating to the lung component. (Authors' summary, modified)

1102
Hartmann, H.,
and O. Wünsche
DECOMPRESSION SICKNESS AND AIR EMBOLISM. —In: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 74-81. Oct. 1963. In English and German.

Thirteen rats out of 15 showed gas bubbles after decompression to 18,000 m. altitude, but only 5 out of 15 showed bubbles after bilateral pneumothorax (2 cc. air) before decompression. When 5 cc. air were injected intra-abdominally, only 2 out of 15 rats showed bubbles. In applying the experiment to man, if decompression symptoms occur within a few seconds after decompression, they probably result from pulmonary air embolism, because several minutes are required for the intravascular liberation of physically dissolved nitrogen.

1103
Hornbein, T. F.
EVALUATION OF IRON STORES AS LIMITING HIGH ALTITUDE POLYCYTHEMIA. —— Jour. Applied Physiol., 17 (2): 243-245. March 1962.

The total amount of iron available from normal body stores and usual dietary intake might be so small as to limit the rate and magnitude of the polycythemic response to high altitude. To evaluate this problem the influence of iron supplementation on blood hemoglobin concentrations was observed in ten members of a Himalayan expedition during the course of their ascent of a 25,660-ft. peak. Half the group received iron supplements in large doses both orally and parenterally; the other five obtained only the iron present in the normal high-altitude diet. Hemoglobin concentrations in both groups increased by 33% over 2 months. No significant difference in hemoglobin concentrations between the two groups was noted at any time during the course of the study. It is concluded that normal iron stores plus dietary iron were adequate to meet the needs of increased hemoglobin synthesis at high altitude in the five individuals who received no iron supplementations. (Author's abstract)

1104
Hornbein, T. F.
ADRENAL CORTICAL RESPONSE TO CHRONIC HYPOXIA. —— Jour. Applied Physiol., 17 (2): 246-248. March 1962.

Although acute oxygen lack causes increased adrenal cortical activity, there is evidence that continued exposure to hypoxia is accompanied by a return of adrenal cortical function to its sea-level status. To evaluate the adrenal cortical response in men living for 14-21 days above 21,000 feet, urinary output of 17-hydroxycorticoids was measured in ten members of a Himalayan mountaineering expedition and compared to values obtained subsequently at sea level. No significant difference in 17-hydroxycorticoid output was observed between the two altitudes. The response of four subjects to the administration of Su-4885 (Methopyrapone) showed that the pituitary-adrenal cortical system was still capable of response to additional stimulation. (Author's abstract)

1105
Hurtado, A.
ACCLIMATIZATION TO HIGH ALTITUDES (HIGH ALTITUDE BIOMETEOROLOGY).—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 418-426. Amsterdam: Elsevier Publishing Company, 1963.

Acclimatization to high altitudes was studied in the permanent inhabitants of the Peruvian Andes. The adaptation mechanisms responsible for the amazing high tolerance to anoxia are of two types: (1) those which result in an economy in the drop of the pO_2 gradient from the inspired air to the capillaries and venous blood, and (2) mechanisms which at tissue level favor the utilization of oxygen. Some of these adaptive mechanisms discussed are: (a) hyperventilation due to an increased sensitivity of the respiratory center to CO_2, (b) a very slight drop in the alveolar-arterial pO_2 gradient, (c) high altitude polycythemia, (d) decreased affinity for oxygen of blood hemoglobin, (e) adjustments of the acid-base balance of the blood, (f) lower lactate production in the active muscle, and other tissue acclimatization mechanisms. Pathological aspects of life at high altitudes include a loss of acclimatization to the low oxygen tension, known as "chronic mountain sickness". This syndrome is characterized by an abnormal degree of hypoxia, exaggerated polycythemia, increased circulating blood volume, and decreased plasma volume.

1106
Johnson, L. F.,
J. R. Neville, and R. W. Bancroft
THE EFFECT OF DECREASED BAROMETRIC PRESSURE ON OXYGEN CONSUMPTION. — School of Aerospace Medicine, Brooks Air Force Base, Tex. (Project no. 7758, Task no. 67074). Technical Documentary Report no. SAM-TDR-62-94, Sept. 1962. iii+6 p.

There have been conflicting reports in the literature concerning the effect of decreased barometric pressure on oxygen consumption, some reports citing a decrease in consumption and others citing no change in consumption. The resting oxygen consumption of 8 healthy men was measured at ground level, at 18,000 feet pressure altitude, and at 30,000 feet pressure altitude. There was no change in oxygen consumption with change in pressure altitude. The findings are discussed from three aspects: (1) the work of breathing at low barometric pressures; (2) the methodology for measuring oxygen consumption; and (3) a possible decreased nitrogen effect. (Authors' abstract)

1107
Johnson, L. F.
THE EFFECT OF DECREASED BAROMETRIC PRESSURE ON MAXIMUM PRESSURE-VOLUME RELATIONSHIPS OF THE HUMAN RESPIRATORY SYSTEM.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775801). Technical Documentary Report no. SAM-TDR-63-62, July 1963. iii+9 p.

Maximum expiratory and inspiratory pressures and the resulting lung-volume changes were simultaneously recorded at ground level (approximately 747 mm. Hg) and at 30,000-feet pressure altitude (225 mm. Hg). For given pulmonary pressures, lung-volume changes were greater at 30,000 feet than at ground level. The area of the maximum pressure-volume diagram at 30,000 feet was 79% of the area of the same diagram at ground level. (Author's abstract)

1108
Johnson, P. K.,
and G. A. Feigen
GROWTH RATE AND BLOOD VOLUME IN TWO STRAINS OF RAT AT A NATURAL ALTITUDE OF 12,470 FEET. — Stanford Med. Bull., 20 (2): 43-55. May 1962.

Immature male and female rats of both the Long-Evans and Slonaker-Wistar strains were randomly selected for maintenance at sea level or for exposure to a natural high altitude of 12,470 feet for 8.5 months. An analysis of the growth kinetics showed, in general, conformance to the logistic growth law in males at sea level, but a marked break at altitude with a resumption after a period of 10 to 15 days. Growth was resumed at the same rate after this interval. The growth pattern of the females was biphasic at sea level as well as at altitude. In general, the slope of the initial phase, which accounts for 80% of the total growth in all cases, was constant. The kinetics of the disappearance of injected T-1824 showed no significant variations owing to sex, strain, or treatment. Very little change was found in the plasma volume at altitude. The packed cell volume, erythrocyte count, and hemoglobin were all significantly increased in the altitude group. Hemoglobin concentration and packed cell volumes were slightly lower in the female, but there was no effect attributable to strain. At altitude there was a general increase in the ratio of mean blood volume to body weight which was attributable to the increased number of erythrocytes. (Authors' summary, modified) (24 references)

1109
Klein, K. E.,
H. Bruner, and D. Jovy
THE IMPORTANCE OF A LONG-TERM SOJOURN IN HIGH MOUNTAIN REGION (ANDES MTS.) FOR THE CONDITIONING OF FLYING PERSONNEL.— In: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- and Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 109-121. Oct. 1963. In English and German.

The physiological responses of three persons in a four weeks' sojourn at 6200 meters was measured. The sojourn, in changing climate, and with performance of moderate physical work, induced a marked adaptation in the unspecific hypophyseo-adreno-cortical system, and distinctly improved the circulation, respiration, and metabolism.

1110
Kovalenko, E. A.
OXYGEN TENSION IN THE BRAIN OF DOGS AT HIGH ALTITUDES BREATHING OXYGEN.— Sechenov Physiol. Jour. USSR (Pergamon Press, New York), 47 (9): 1241-1250. Feb. 1962.
English translation of: Napriazhenie kisloroda v golovnom mozgu u sobak v usloviakh vysoty pri dykhanii kislorodom.—Fiziologichaskii zhurnal SSSR (Moskva), 47 (9): 1134-1141. Sept. 1961. In Russian.

Brain oxygen tension was reduced in dogs during ascents to 12,000 m. altitude without oxygen by more than one half in the cortex and by more than two-thirds in the subcortex. Pronounced hypoxic disturbances were noted at this time. When the dogs were raised to the same altitude while breathing oxygen, the oxygen tension was reduced by an average of one-fourth in the cortex, and one-third in the subcortex, without visible signs of hypoxic disturbances. (Author's summary, modified)

1111
Kovalenko, E. A.
[THE EFFECT OF HIGHLY RAREFIED ATMOSPHERE ON THE OXYGEN TENSION IN BRAIN TISSUE] O vliianii vysokikh stepenei razrezheniia atmosfery na napriazhenie kisloroda v tkaniakh mozga. — Fiziologicheskii zhurnal SSSR (Moskva), 48 (2): 150-158. Feb. 1962. In Russian.

Experiments were conducted with dogs to explore the "time reserve" at a simulated altitude of 15,000 m., virtually equivalent to a vacuum. In the first 17-25 seconds there was weakening of the muscle tone, loss of the postural reflex, and the animal collapsed. After 55-105 seconds respiration ceased completely, which at any given altitude marks the critical time after which irreversible changes set in. In these experiments oxygen tension in the brain fell sharply to one-third of the initial level in the cerebral cortex, and to one-fifth in the subcortical centers. Upon repeated ascents to 15,000 m. simulated altitude there was a relative extension of the "time reserve" (up to cessation of respiration). The degree of oxygen tension determined by local measurements at the tips of implanted platinum electrodes did not always correspond to the severity of hypoxic symptoms observed. (Author's summary, modified)

1112
Kovalenko, E. A.,
and F. V. Babchinskii
[THE EFFECT OF COMPENSATION FOR EXCESSIVE INTRAPULMONARY PRESSURE ON THE OXYGEN TENSION IN THE CEREBRAL TISSUE DURING THE ASCENT TO HIGH ALTITUDES] Vliianie kompensatsii izbytochnogo vnutrilegochnogo davleniia na napriazhenie kisloroda v tkaniakh mozga pri pod'emakh na bol'shie vysoty. — Fiziologicheskii zhurnal SSSR (Moskva), 48 (10): 1203-1208. Oct. 1962. In Russian.

Dogs breathing oxygen under pressure were decompressed in an altitude chamber. If the intrapulmonary pressure was not properly compensated by a pressure suit, the animals developed hypoxia of the brain tissues and motor and respiratory disturbances; when, however, an adequate pressure suit was worn, the animals tolerated decompression without a decrease in the oxygen tension of the brain. Dogs without pressure suits, rapidly decompressed to altitudes of 15, 17, or 20 km. while pressure breathing, survived only a few minutes.

1113
Kovalenko, E. A.
[THE PROBLEM OF THE MECHANISM OF DEVELOPMENT OF HIGH-ALTITUDE TISSUE EMPHYSEMA] K voprosu o mekhanizme razvitiia vysotnoi tkanevoi emfizemy.—Problemy kosmicheskoi biologii (Moskva), 2: 399-406. 1962. In Russian, with English summary (p. 406).
English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 407-413. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 36-21437)

In experiments with rats under conditions of severe decompression (to about 7 mm. of Hg) there is a marked increase in the animal's size, separation of the skin from the adjacent tissues, and development of subcutaneous bubbles along with signs of acute hypoxia. Within the first few seconds after formation of the bubbles there is an increase in pressure within the subcutaneous bubble to 30-60 mm. of mercury, after which it remains constant. During the first 10-20 seconds nitrogen predominates in the gas composition of the subcutaneous emphysema bubble; subsequently there is an increase in the carbon dioxide content.

1114
Lafontaine, E.,
and J. Lavernhe
THE EFFECTS OF DECOMPRESSION ON BOARD TRANSPORT AIRCRAFT.—Interavia (Geneva), 17 (12): 1630-1631. Dec. 1962.

On board pressurized aircraft, accidental decompression presents a considerable safety problem. Decompression may originate from failure of windows, doors, valves, etc., fire, smoke, fuselage fractures, structural failure, pressurization system failure, and collisions. The physiological effects of loss of pressurization are related to the rapidity of decompression and to the final cabin altitude attained. The physiological effects are classed into three groups: mechanical (violent blast causing passenger injury by throwing them against cabin walls etc.), physical (ranging from frostbite to air embolism), and chemical, which leads to violent reduction of the oxygen content in the lungs causing anoxia and unconsciousness. Rapid descent as laid down by safety regulations in the event of pressurization failure is the first safety measure. Another measure is the use of individual oxygen masks by the aircrew to prevent anoxia. A third concerns the designer and operator to protect against the mechanical effects of rapid decompression.

1115
Lalli, G.,
and D. Poggi
[EFFECT OF EXPLOSIVE DECOMPRESSION ON BLOOD COAGULATION IN THE RABBIT] Influenza della decompressione esplosiva sulla coagulazione del sangue nel coniglio. — Rivista di medicina aeronautica e spaziale (Roma), 25 (3): 500-505. July-Sept. 1962. In Italian, with English summary (p. 504).

Rabbits decompressed in 0.14 seconds from 0 to 13,000 m. altitude demonstrated a shortening of the recalcification time of Howell, and a thrombophilic pattern of the thromboelastogram (shortening of reaction and coagulation times, increase of maximum amplitude, elasticity standard, and thromboelastographic index). Insignificant increases were observed in the number of platelets, and changes in Quick time, prothrombin, factors V and VII, and fibrinolysis in the presence of an activator.

1116
Leverett, S. D.,
H. L. Bitter, and R. G. McIver
STUDIES IN DECOMPRESSION SICKNESS: CIRCULATORY AND RESPIRATORY CHANGES ASSOCIATED WITH DECOMPRESSION SICKNESS IN ANESTHETIZED DOGS.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775802). Technical Documentary Report no. SAM-TDR-63-7, March 1963. 12 p.

The physiologic effects of intravascular bubbles were studied in 24 dogs. High and low atmospheric pressures were used, as well as direct introduction of air bubbles into the circulation. In all cases, the signs appearing as the result of intravascular bubbles were: (1) marked tachypnea and (2) marked pulmonary arterial hypertension. Bubbles appeared first in the venous circulation, and were not seen in the arterial circulation until near collapse. Bubbles produced at altitude did not completely disappear on returning to ground level. (Authors' abstract)

1117
Marotta, S. F.,
J. P. Marbarger, and E. F. Robbins
GASEOUS TISSUE NITROGEN OF RATS EXPOSED TO SIMULATED ALTITUDE AND HIGH CONCENTRATIONS OF NITROGEN.—Univ. of Illinois Medical Center. Aeromedical Lab., Chicago, Ill. (Contract AF 41(657)-332); issued by School of Aerospace Medicine, Brooks Air Force Base, Tex. (Project no. 7758, Task no. 59613), Technical Documentary Report no. SAM-TDR-62-113, May 1963. iii+5 p.

One hundred and fifty albino male rats were subjected to 12,000 feet simulated altitude while breathing ambient air (Group II) or 100% oxygen (Group III) for one-half, two, and four hours. When compared with control animals (Group I) gaseous nitrogen was eliminated more rapidly in Group III than in Group II. The clearance of nitrogen from liver, skeletal muscle, and testis was more rapid, however, when animals were denitrogenated with 100% oxygen at ground level than at altitude, The reverse was observed for splenic nitrogen. Muscular and splenic gaseous nitrogen increased when animals were subjected to 10% oxygen in nitrogen (Group IV). These observations suggest that local as well as total circulatory alterations accompanying either decompression, the breathing of gas mixtures, or both, may affect the rate of denitrogenation. (Authors' abstract)

1118
Martin-Laland, J.
[STUDY OF THE EVENTUAL VARIATIONS OF PULMONARY VOLUMES DURING RESPIRATORY ACCLIMATIZATION TO 3,600 M. ALTITUDE] Étude des variations éventuelles des volumes pulmonaires au cours de l'acclimatement respiratoire à l'altitude 3600 m.—Revue de médecine aéronautique (Paris), 1 (3): 83-86. March-April 1962. In French.

Respiratory studies were made on seven subjects, natives of the plains, during a 15-20 day stay on Mont Blanc (3,613 m.). At rest during the period of rapid acclimatization to altitude, either the first or fifteenth day at 3600 m., a significant and constant increase occurred in minute ventilation resulting from the elevation of the volume of the air current. No major modification of respiratory frequency was found. During effort an increase was observed in the maximum minute ventilation which was caused by elevation of the frequency without major modification of the volumes utilized. The reserve inspiratory volume (VIR) decreased almost in the same proportions that the air current increased, and the reserve expiratory volume increased contrary to the VIR in the same scale of values.

1119
Mazzella, G.,
and A. M. De Angelis
[BEHAVIOR OF THE LEUKOCYTE SEDIMENTATION RATE IN SUBJECTS EXPOSED TO BAROMETRIC DECOMPRESSION] Comportamento della leucosedimetria in soggetti sottoposti a depressione barometrica.—Rivista di medicina aeronautica e spaziale (Roma), 26 (2): 246-255. April-June 1963. In Italian, with English summary (p. 253).

Leukocyte and erythrocyte sedimentation rates were studied in 20 pilot candidates, about 21 years of age, who were exposed to a simulated altitude of 5500 meters in a decompression chamber for 60 minutes. The average values of sedimentation indices in both gravimetric tests were not statistically significant for the esposure time and altitude. This experiment indicates that qualitative and quantitative changes in leukocytes in acute hypoxic hypoxia as reported in the literature are not such as to modify their sedimentation index. Included are representative tabulations of the indices.

1120
Metcalfe, J.,
G. Meschia, H. Hellegers, H. Prystowsky, W. Huckabee, and D. H. Barron
OBSERVATIONS ON THE PLACENTAL EXCHANGE OF THE RESPIRATORY GASES IN PREGNANT EWES AT HIGH ALTITUDE. —Quart. Jour. Exper. Physiol. (London), 47 (1): 74-92. Jan. 1962.

The oxygen and carbon dioxide contents and tensions were determined in the maternal arterial, uterine venous, umbilical arterial and umbilical venous bloods respectively, at selected stages of gestation in a series of pregnant sheep bred and pastured at high altitude, about 14,000-15,000 feet, in the Peruvian Andes. The results demonstrate that despite the lowered oxygen tensions in the maternal uterine, and presumably in the maternal placental capillaries, the oxygen tension in the umbilical vessels is similar to that reported for fetuses carried by ewes at sea level. The probable mechanisms through which the fetus carried by a ewe at altitude obtains an adequate oxygen supply from the maternal blood despite the lowered tension in that source are discussed. (Authors' abstract)

1121
Metz, J.,
N. W. Levin, and D. Hart
EFFECT OF ALTITUDE ON THE BODY/VENOUS HAEMATOCRIT. —Nature (London), 194 (4827): 483. May 5, 1962.

Red blood cell volume was measured in 18 male residents at sea level and in 18 males resident at an altitude of 5,740 feet. Red blood cells were labeled with chromium^{51}, and plasma volume was labeled with radio-iodinated serum albumin. The subjects resident at altitude showed a rise in body hematocrit, red cell volume, and venous hematocrit, with the body/venous hematocrit ratio nearer to unity (0.962) as compared to values measured at sea level (0.902). Practical applications of the results are discussed.

1122
Milledge, J. S.
ELECTROCARDIOGRAPHIC CHANGES AT HIGH ALTITUDE. —Brit. Heart Jour. (London), 25 (3): 291-298. May 1963.

Serial electrocardiograms were taken on climbers during the 1960-1961 Himalayan Scientific and Mountaineering Expedition, who spent approximately five months at 19,000 ft., and subsequently at up to 24,000 ft. There was a shift of direction of the QRS and T vectors to the right in the frontal plane. In the precordial leads, there was a shift to the left of the transitional zone of the QRS complex and inversion of the T wave spreading across from right to left (from V1-2 to V4-5), i.e., a backward shift of the QRS and T vector in the sagittal plane. Oxygen breathing did not reverse these changes except in the first oxygen experiment. A decrease was observed in the amplitude of the QRS voltage which was reversed by oxygen breathing. The cardiogram at altitude showed unmistakable signs of right ventricular overload; but the most significant finding was that the cardiograms of men as high as 24,400 ft. showed so little evidence of the severe physiological stress under which they were working. Included are representative electrocardiograms and tables.

1123
Motobayashi, F.,
G. Miltarai, S. Ando, and S. Takagi
EFFECT OF LOW PRESSURE ON EEG AND RETINO-CORTICAL TIME IN UNRESTRAINED RABBITS.—Annual Report Research Inst. Environmental Med., Nagoya Univ. (Nagoya), 10 [for 1961]: 1-5. 1962. In English.

Rabbits had electrodes implanted in the visual cortex and the hippocampus prior to chronic high-altitude experiments. For these experiments they were placed each day for fours hours in a low-pressure chamber which was decompressed to values ranging from 150 to 200 mm. Hg. Four stages of consciousness were distinguished on the basis of electroencephalograms: (1) normal up to 2.5 km. altitude, (2) high excitation level at altitudes from 3 to 5 km., (3) low excitation level at altitudes from 7 to 9 km., and (4) lethargy prior to death at altitudes above 9 km. The altitudes corresponding to the brain wave patterns shifted after repeated exposures to low atmospheric pressure as a result of acclimatization. In the second part of the experiments retino-cortical times (the interval from the beginning of the stimulus light flash to the peak of the first deflection of the response of the visual cortex) were prolonged under low atmospheric pressure with the longest times recorded just before death. In the surviving animals the retino-cortical time decreased somewhat to rise to a second peak upon recompression. All these changes were reduced after repeated experiments. It is suggested that preservation of the electroencephalographic pattern and retino-cortical time may be used as indicators in tracing the process of acclimatization to low atmospheric pressure.

1124
Nückel, H.
METHODS OF TREATING VARIOUS DISEASES.—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 640-642. Amsterdam: Elsevier Publishing Company, 1963. 991 p.

Low-pressure chamber treatment is considered beneficial in the following conditions: spastic bronchitis (inflammation of bronchi) and bronchiolitis (inflammation of the bronchioles), bronchial asthma, the sinobronchial syndrome (i.e., chronic sinusitis accompanied by slime and purulent discharge), pneumoconiosis (i.e., lung fibrosis due to silicosis, siderosis, etc.) pertussis, certain anemias, and dysfunctions of the endocrine and autonomic nervous systems. It is contra-indicated in all conditions of oxygen deficiency of the heart muscle, high degree of anemia, lung tuberculosis, acute infections of the respiratory tract and the Eustachian tube, acute rhino-pharyngitis, acute gastro-duodenal ulcers, colostomy, laparatomy, epilepsy, capillary fragility, high liquor pressure, and recent lumbar puncture. Examples of low-pressure treatment describe therapy in cases of bronchial asthma, pneumoconiosis, pertussis, mild anemia, endocrine function, autonomic nervous system dysfunction, general convalescence, prophylaxis, thyroid, and polyarthritis. (75 references)

1125
Okamoto, E.,
H. Ikenoue, and H. Fujihara
[STATISTICAL OBSERVATIONS OF THE SELF-AWARENESS DURING HYPOXIA] [Abstract]. — In: Abstracts of the 7th Meeting of the National Defense Medical Society. Bōei Eisei (National Defense Medical Journal) (Tokyo), 9 (3): 101-102. March 1962. In Japanese.

At a simulated altitude of 8000 meters, 82 men removed their oxygen masks. In general, there was inhibition of the central nervous system but with some individual variations in reaction. Vision decreased accompanied by abnormal color perception in the red and yellow. In some men there was a hot sensation in the head and face, but self-awareness of pain was not generally noted. A discussion is included.

1126
Peñaloza, D.,
F. Sime, N. Banchero, R. Gamboa, J. Cruz, and E. Marticorena
PULMONARY HYPERTENSION IN HEALTHY MEN BORN AND LIVING AT HIGH ALTITUDES. — Amer. Jour. Cardiol., 11 (2): 150-157. Feb. 1963.

Mild pulmonary hypertension and a moderate increase of the pulmonary vascular resistance and right ventricular work were found in men between 17 and 34 years of age living permanently at high altitudes (14,200-14,900 ft.). Pulmonary wedge pressure, cardiac output, and heart rate did not show significant differences from data obtained at sea level. Changes occurring in the heart and pulmonary circulation in men living permanently at high altitudes are not comparable with changes described in temporary residents at altitude, nor with those experimentally obtained by acute hypoxia. The augmented pulmonary vascular resistance in the high-altitude dweller is related to the anatomic changes in the small pulmonary arteries and arterioles. Functional factors such as vasoconstriction, hypervolemia, and polycythemia do not play an important role in the mechanism of high-altitude pulmonary hypertension. It is possible that pulmonary hypertension, in association with other factors such as hyperventilation and an extensive capillary bed of the lungs, does play a role in improving the arterial oxygenation in men living at high altitude. (Authors' summary, modified) (38 references)

1127
Petit, J. M.,
G. Milic-Emili, and J. Troquet
[MAXIMUM MECHANICAL WORK OF THE THORAX AND ALTITUDE] Travail mécanique maximum du thorax et altitude.—Revue de médecine aéronautique (Paris), 2 (7): 273-276. May-June 1963. In French.

The maximum mechanical work of the thorax was determined during forced respiratory cycles in a decompression chamber at simulated altitudes of 34 m., 2,500 m., 5,000 m. and 7,500 m. As the altitude increased along with the increase in air compressibility, thoracic mechanical work decreased. Kinetic pressure volume diagrams demonstrated the accrued effect of altitude, especially during the initial phase of expiration. This may be due to the rapid rate of expiratory muscular contractions. The decrease of maximum mechanical power in the thoraco-pulmonary apparatus is an unfavorable sign for a stay at altitude.

1128
Petit, J. M.,
G. Milic-Emili, and J. Troquet
[DYNAMIC PULMONARY WORK AND ALTITUDE] Travail dynamique pulmonaire et altitude.—Revue de médecine aéronautique (Paris), 2 (7): 276-279. May-June 1963. In French.

A reduction was observed in the dynamic pulmonary work of two subjects during progressively increasing hyperventilation induced by rebreathing expired air. The measurements were carried out with pure oxygen in a decompression chamber at simulated altitudes of 34 m., 2500 m., 5000 m., and 7500 m. The reduction was principally a decrease in resistance to turbulent movements associated with the decreased gas density at altitude. The scope of these results is discussed: the Rohrer equation being notably empirical.

1129
Picón-Reátegui, E.
STUDIES ON THE METABOLISM OF CARBOHYDRATES AT SEA LEVEL AND AT HIGH ALTITUDES. — Metabolism, 11 (11): 1148-1154. Nov. 1962.

A comparative study was made of the changes in blood glucose, lactate, pyruvate, plasma inorganic phosphate, and plasma potassium after oral administration of glucose in two groups of adult men, one being residents at sea level, the other residents at an altitude of 14,900 feet. Although the glucose concentrations in both arterial and venous blood were consistently lower in the altitude group, the trend of the curves, after oral administration of glucose, followed similar patterns in both groups. While net changes were of the same magnitude at both altitudes, the curve described by the high-altitude group was lower; this may be due to the lower initial glucose concentration, as well as to greater carbohydrate utilization during the first 30-minute interval in this group. Behavior of plasma inorganic phosphate and plasma potassium were the same at both altitudes. There is no satisfactory explanation for the lower blood glucose level in the high-altitude resident in the fasting state nor for the difference in lactate and pyruvate responses in both altitudes at the end of the experiment. (Author's abstract)

1130
Pugh, L. G. C. E.
PHYSIOLOGICAL AND MEDICAL ASPECTS OF THE HIMALAYAN SCIENTIFIC AND MOUNTAINEERING EXPEDITION, 1960-61. — Brit. Med. Jour., no. 5305: 621-627. Sept. 8, 1962.

Physiological investigations were conducted over a period of five months in a prefabricated laboratory situated at 19,000 ft. during an attempted ascent of Mt. Makalu (27,790 ft.). At 24,400 ft. the maximum oxygen intake was found to be 1.4 liter/minute, ventilation 119 liters/minute, and heart rate 135 beats/minute. Haldane end-expiratory gas samples taken at rest at 25,700 ft. showed an average oxygen tension of 33 mm. Hg and carbon dioxide tension of 14 mm. Hg. Arterial oxygen saturation less than 50% was observed during periods of two to three minutes' maximum exercise at 19,000 ft., the average resting value being 67%. The party appeared to acclimatize well to 19,000 ft., and card-sorting and other psychological tests revealed no evidence of mental impairment. However, all members of the party continued to lose weight. Newcomers on Mt. Makalu, after four to six week's acclimatization were fitter and more active than men who wintered at 19,000 ft. On Mt. Makalu cases occurred of cerebral thrombosis, pulmonary infarction, acute pulmonary edema, pneumonia and frostbite. The ascent was made without oxygen equipment, but oxygen was available for medical treatment. (From the author's summary)

1131
Reeves, J. T.,
E. B. Grover, and R. F. Grover
PULMONARY CIRCULATION AND OXYGEN TRANSPORT IN LAMBS AT HIGH ALTITUDE.—Jour. Applied Physiol., 18 (3): 560-566. May 1963.

The oxygen transport and pulmonary hemodynamics of lambs native to low altitude were evaluated in Denver and on Mount Evans (12,700 ft.). Because the hemoglobin-oxygen dissociation curve is placed well to the right of most other mammals, markedly depressed arterial oxygen saturations (59%) occurred at high altitude. However, the lambs adapted remarkably well and showed normally rapid growth. The mixed venous oxygen tension was relatively well maintained, primarily by a narrowing of the arterio-venous oxygen gradient to 11 mm. Hg. Despite the marked hypoxemia, elevation of the pulmonary artery pressure was not a consistent finding, and when it occurred it was neither marked nor sustained. (Authors' abstract)

1132
Reeves, J. T.,
E. B. Grover, and R. F. Grover
CIRCULATORY RESPONSES TO HIGH ALTITUDE IN THE CAT AND RABBIT.—Jour. Applied Physiol., 18 (3): 575-579. May 1963.

Cats were taken from Denver (5,200 ft.) to Mt. Evans (14,150 ft.) anticipating that this degree of hypoxia would induce pulmonary hypertension. Rabbits were included for comparison with the cat. All cats died without developing pulmonary hypertension or right heart failure, and in spite of arterial and mixed venous oxygen tensions maintained well above those of the rabbit. Presumably the cat's failure to survive was not a failure of oxygen transport to the arterial blood, or to the systemic capillaries. Paradoxically, five of eight rabbits survived despite poor arterial blood oxygenation. The rabbits developed marked polycythemia associated with modest right ventricular hypertension and dilatation. (Authors' abstract)

1133
Reichel, H.
[CARDIAC DEATH IN THE MOUNTAINS FROM THE VIEWPOINT OF A PHYSIOLOGIST] Der Herztod im Hochgebirge in der Betrachtung des Physiologen. — Sportarzt (Koln), 13 (3): 65-67. March 1962. In German.

The effect of hypoxia on the cardiovascular system is reviewed from a practical standpoint. Even a relatively slight decrease in the oxygen saturation of the arterial blood at low altitudes (2000-2500 m.) may become the cause of serious disturbances in the heart excitatory rhythm due to hypoxia of the heart chamber musculature in the case of coronary sclerosis, and may result in ventricular fibrillation. The use of mountain highways or mountain passes should be contraindicated in the presence of any minor symptoms of an existing coronary sclerosis (angina pains). Particular caution should be exercised with all individuals past forty years of age.

1134
Reynafarje, B.
MYOGLOBIN CONTENT AND ENZYMATIC ACTIVITY OF MUSCLE AND ALTITUDE ADAPTATION. — Jour. Applied Physiol., 17 (2): 301-305. March 1962.

Quantitative determinations of myoglobin were made in the sartorius muscle of healthy human subjects native to sea level and high altitude. The specific activities of the reduced form of diphosphopyridine nucleotide oxidase (DPNH-oxidase), DPNH-, and the reduced form of triphosphopyridine nucleotide (TPNH)-cytochrome c reductase, transhydrogenase, and isocitric and lactic dehydrogenases were also examined. There was found a significantly higher myoglobin concentration in the muscle of the high-altitude native as compared with the sea-level resident. The enzyme systems DPNH-oxidase, TPNH-cytochrome c reductase, and transhydrogenase similarly showed a significantly higher activity in the altitude resident. It was concluded that the respiratory capacity of the muscle was apparently higher in the altitude native than in the sea-level one. The enhanced enzymatic activity was probably related to the higher pigment content of the skeletal muscle. Results of myoglobin determinations in several other muscles from certain sea-level patients are discussed. (Author's abstract)

1135
Reynafarje, B.
PYRIDINE NUCLEOTIDE OXIDASES AND TRANSHYDROGENASE IN ACCLIMATIZATION TO HIGH ALTITUDE. — Inst. of Andean Biology and Faculty of Medicine, Lima, Peru (Contract AF 41(657)-249); issued by School of Aerospace Medicine, Brooks Air Force Base, Tex. (Project no. 7758, Task no. 59582). Technical Documentary Report no. SAM-TDR-62-88, Nov. 1962. iii+6 p.

Activity of pyridine nucleotide oxidases and transhydrogenase has been examined in heart, liver, and rectus femoris muscle of guinea pigs native of sea level and high altitude. There was an enhanced, reduced form of diphosphopyridine nucleotide oxidase (DPNH-oxidase) and transhydrogenase activity in heart and muscle from animals adapted to high altitude. The higher activity in muscle at altitude was due solely to increase in ratio of red to white portions. Both groups showed the pigmented portion twice as active as the white one. In liver, neither the DPNH-oxidase system nor the transhydrogenase was significantly changed in their activity on a fresh-weight basis. Nevertheless, the DPNH-oxidase was higher at altitude when the activity was expressed per gram of nitrogen. The reduced form of triphosphopyridine nucleotide oxidase activity was not appreciably changed in any of the tissues. It is concluded that adaptation to high altitude is associated with apparent changes in the magnitude of the electron transport pathway. Increased activity in skeletal muscle is probably related to the tissue pigment content. (Author's abstract)

1136
Reynafarje, B.
MYOGLOBIN CONTENT AND ENZYMATIC ACTIVITY OF HUMAN SKELETAL MUSCLE: THEIR RELATION WITH THE PROCESS OF ADAPTATION TO HIGH ALTITUDE.—Inst. of Andean Biology, Faculty of Medicine, Lima, Peru (Contract AF 41(657)-249); issued by School of Aerospace Medicine, Brooks Air Force Base, Tex. (Project no. 7758, Task no. 59582). Technical Documentary Report no. SAM-TDR-62-89, Nov. 1962. iii + 8 p.

Quantitative determinations of myoglobin were made in the sartorius muscle of healthy human subjects native of sea-level and high-altitude areas. The specific activity of the reduced form of diphosphopyridine nucleotide oxidase (DPNH-oxidase), DPNH- and TPNH-cytochrome C reductases, transhydrogenase, and isocitric and lactic dehydrogenases were also examined. A significantly higher myoglobin concentration was found in the muscle of the high-altitude natives as compared with sea-level residents. The enzyme systems DPNH-oxidase, TPNH-cytochrome C reductase, and transhydrogenase similarly showed a significantly higher activity in altitude residents. It was concluded that the respiratory capacity of the muscle was apparently higher in natives living at high altitude than in those living at sea level. The enhanced enzymatic activity was probably related to the higher pigment content of the skeletal muscle. Results on myoglobin determinations in several other muscles from certain sea-level patients are discussed. (Author's abstract)

1137
Saldaña, M.,
and J. Arias-Stella
STUDIES ON THE STRUCTURE OF THE PULMONARY TRUNK. II. THE EVOLUTION OF THE ELASTIC CONFIGURATION OF THE PULMONARY TRUNK IN PEOPLE NATIVE TO HIGH ALTITUDES.—Circulation, 27 (6): 1094-1100. June 1963.

The type of elastic configuration of the pulmonary trunk was studied in 267 high-altitude dwellers, of all ages, who died accidentally or due to noncardiovascular diseases. It was shown that in places between 13,250 to 14,900 feet above sea level, development of the elastic configuration of the pulmonary trunk is characterized by maintenance of the "aortic" type up to 9 years. This elastic type evolves exclusively into the "persistent" configuration, which is observed for the rest of life. However, conversion of the "persistent" type into the "adult" type can be observed, especially after 60 years of age. In places located between 11,300 to 12,600 feet of altitude, the "aortic" type of pulmonary trunk is retained up to 3 years. Cases with "transitional" configuration can be observed, but apparently they rapidly evolve into the "persistent" type. This elastic configuration is observed principally in childhood and adolescence and is also present in a great proportion of young adults. By 55 years, approximately, the totality of cases has become of the "adult" type. These facts strongly suggest that pulmonary hypertension is the determining cause of the differences found in relation to sea level cases. (Authors' summary and conclusions, modified)

1138
Saldaña, M.,
and J. Arias-Stella
STUDIES ON THE STRUCTURE OF THE PULMONARY TRUNK. III. THE THICKNESS OF THE MEDIA OF THE PULMONARY TRUNK AND ASCENDING AORTA IN HIGH ALTITUDE NATIVES. —Circulation, 27 (6): 1101-1104. June 1963.

Measurements of the thickness of the media of the pulmonary trunk and ascending aorta were made in 200 normal autopsy cases ranging in ages from birth to 80 years. One hundred cases were persons who were born and had lived permanently in places between 11,300 to 14,900 feet above sea level. One hundred persons of comparable ages, born at sea level, served as control. It is shown that at high altitudes the pulmonary trunk exhibited a thicker media than at sea level, in the course of the whole of life. This fact is explained by the occurrence, at high altitudes, of a mild degree of pulmonary arterial hypertension from birth. The media of the ascending aorta of high altitude natives was found to be thinner than that of sea level inhabitants, after 30 years. This characteristic appears to be related to the existence of a lower systolic pressure at high altitudes than at sea level. (Authors' summary)

1139
Schmidt-Kessen, W.
[THE ROLE OF ALTITUDE EFFECTS IN CLIMATIC THERAPY INLAND] Die Rolle der Höhenwirkung bei der Klimatherapie im Binnenland.—Archiv. für physikalische Therapie (Leipzig), 14 (3): 155-163. May-June 1963. In German.

The threshold for the effects of altitude is not an absolute value in climatic therapy, rather it depends on the condition of the individual patient. Patients with cardiac insufficiency tolerate adequately even the highest peaks of medium-range mountains; their altitude tolerance may be lowered by a secondary limitation of pulmonary function. Pulmonary insufficiency affects altitude tolerance in different ways, depending upon the specific mechanism of the dysfunction; compensation of the lowered oxygen partial pressure in the air is lowest for patients with disturbances of pulmonary diffusion. Transient changes in the lung function by physical stresses, air pollution, or in sleep may cause the oxygen saturation of arterial blood to be lowered temporarily at altitudes where it is normally unchanged. The lowering of the oxygen partial pressure in the air exerts biological effects before it is possible to show a definite drop in the oxygen saturation of the arterial blood. As causal factors are suggested short-term drops in arterial oxygen saturation and local lowering of the oxygen partial pressure in particularly sensitive cells. (67 references)

1140
Serova, L. V.
[CHANGES IN TISSUE RESISTANCE DURING ACCLIMATIZATION OF ANIMALS TO MODERATE HYPOXIA UNDER NATURAL CONDITIONS] Izmenenie rezistentnosti tkanei pri akklimatizatsii zhivotnykh k umerennoi gipoksii v estestvennykh usloviiakh.—Fiziologicheskii zhurnal SSSR (Moskva), 49 (5): 643-647. May 1963. In Russian.

Three groups of rats were used in the tests: Group I (controls) was kept in Moscow, Group II was exposed to an altitude of 2000 m. for 90 days, and Group III was kept at 2000 m. for one month and then transferred to the immediate proximity of a hydroelectric power plant where the positive ion concentration was $19 \times 10^3/\text{cm.}^3$. After sacrificing the animals the tissue resistance to adverse agents (Ringer's solution, caffeine) was determined by the method of vital staining. Adsorption of neutral red by the diaphragm and the brain tissues in Group II was 54.8% and 79.5%, respectively, as compared with controls; in Group III the respective numbers were 44.3% and 71.9%. It is concluded that the decreased adsorption capacity of the tissues of animals exposed to hypoxia is due to structural changes in tissue proteins.

1141
Sihm, D. W.
EFFECTS OF SIMULATED HIGH ALTITUDE ON THE TISSUE RESPIRATION OF VARIOUS ORGANS. II. OXYGEN CONSUMPTION RATES OF THE TISSUES OF ORGANS IN STARVED ALBINO RATS.—Republic Korea Air Force, Jour. Aviation Med. (Seoul), 10 (1): 17-22. June 1962. In Korean, with English abstract (p. 21-22).

A notable decrease was found in testicular, liver, and kidney weight of rats starved for six days and exposed to simulated altitude. The brain and endocrine glands showed little weight change. The oxygen consumption in liver, kidney, muscle, brain, adrenal, thyroid, and testis decreased significantly in comparison to control animals under both atmospheric and simulated high-altitude conditions. A decrease was found in the oxygen consumption of kidney, cerebral cortex, adrenal gland, and thyroid gland of starved rats under 7% and 21% oxygen, and an even greater decrease in liver, muscle, and testes. This latter decrease in starved rats under hypoxia may be attributed to the decreased rate of oxygen utilization. (Author's abstract, modified)

1142
Sime, F.
N. Banchero, D. Peñaloza, R. Gamboa, J. Cruz, and E. Marticorena
PULMONARY HYPERTENSION IN CHILDREN BORN AND LIVING AT HIGH ALTITUDES. —— Amer. Jour. Cardiol., 11 (2): 143-149. Feb. 1963.

Thirty-two healthy children aged 1 to 14 years, born and living at Morococha, Peru (14,900 ft.), and Cerro de Pasco, Peru (14,200 ft.), were studied by means of right-heart catheterization. Mild pulmonary hypertension and increased pulmonary vascular resistance were found. Values of cardiac output and pulmonary wedge pressure were similar to those at sea level. Increased pulmonary vascular resistance was ascribed to structural changes in the small pulmonary arteries and arterioles. Pulmonary hypertension was greater in children than in adults of high altitudes, and greater in children under 5 years of age than in those 6 to 14. In the young group pulmonary pressures were similar to those of newborn at sea level. This signifies that at high altitudes there is a delay in the evolution of pulmonary pressures with aging, in contrast to what occurs at sea level. The slow evolution agrees with the regression of right ventricular hypertrophy at high altitudes as demonstrated by anatomic, electrocardiographic, and vectorcardiographic studies. Pulmonary hypertension can be considered a form of primary pulmonary hypertension. The role of pulmonary hypertension in the high incidence of patent ductus arteriosus at high altitude is discussed. (Authors' summary, modified) (30 references)

1143
Simins, D. G.,
D. E. Flinn, and B. Hartman
PSYCHOPHYSIOLOGY OF HIGH-ALTITUDE EXPERIENCE.—In: Unusual environments and human behavior, p. 127-164. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

The psychophysiological problems involved in maintaining men at high altitude are described under three general categories: acute physiological stress of a few hours' duration, acute fatigue stress in excess of 24 hours of continuous duty, and task commitment stress of many days' duration. The data obtained from ballon flights and high altitude chamber are discussed in detail. There are indications that short space flights involving continuous work by the astronaut should be started at a point in the day when diurnal effects will be minimized. (30 references)

1144
Śmigielski, S.
[EFFECT OF HYPOXEMIA AT HIGH ALTITUDE ON THE METABOLISM OF METHIONINE S^{35} IN THE LIVER OF WHITE MICE] Wpływ niedotlenienia wysokościowego na przemianę metioniny S^{35} w wątrobie białych myszy.—Lekarz wojskowy (Warszawa), 39 (1): 16-23. 1963. In Polish, with French summary (p. 33).

Mice received an intraperitoneal injection of methionine S^{35} and were decompressed to simulated altitudes of 8,000-8,500 m. After 6, 12, 24, and 48 hours, ten experimental and ten control animals were killed and the livers examined. Methionine S^{35} was found to be less strongly fixed in the livers of the hypoxic mice. The indices of methionine S^{35} metabolism in the fat and albumin fractions were smaller in the animals subjected to hypoxemia.

1145
Smith, D. C.,
J. Q. Barry, and A. J. Gold
RESPIRATORY ALKALOSIS AND HYPOKALEMIA IN DOGS EXPOSED TO SIMULATED HIGH ALTITUDE. —— Amer. Jour. Physiol., 202 (6): 1041-1044. June 1962.

Exposure of restrained, unanesthetized dogs to a simulated altitude of 30,000 feet consistently resulted in respiratory alkalosis and marked hypokalemia. When alkalosis was prevented by increasing the carbon dioxide tension of inspired air during decompression, a smaller but statistically significant decrease in plasma potassium concentration still occurred. In comparison with previous studies, the hypokalemia observed in these restrained, unanesthetized dogs was greater than that found in either unrestrained or anesthetized dogs subjected to the same decompression stress. Consequently, the suggestion is made that in the unanesthetized, restrained dog, the hypokalemic response not attributable to respiratory alkalosis is of adrenal mediation and results from the "stress" of restraint plus hyperventilation, rather than to hypoxemia or the decompression stress, per se. (Authors' abstract)

1146
Sokolova, L. S.,
S. B. Tikhvinskii, and N. I. Tavastsherna
[ACCLIMATIZATION PERIODS OF MOUNTAIN-SKIERS DURING PRELIMINARY AND BASIC TRAINING] Sroki akklimatizatsii v gorakh u gornolyzhnikov v podgotovitel'nom i osnovnom periodakh trenirovki.—Teoriia i praktika fizicheskoi kul'tury (Moskva), 25 (10): 28-30. Oct. 1962. In Russian.

Skiers underwent training at an altitude of 1750 m. for a period of approximately 30 days. Upon arrival the test subjects showed an increase in blood flow, pulse, and respiration rates, intensification in the oxidative processes (shortening of the A-B interval of the oxyhemogram), augmented motor reactions, and vestibular instability. Approximately 8 to 12 days after arrival, all indices reached values established during the preliminary training period conducted at sea level and considered to be normal. The following tables are included: pulse, respiration, and blood flow rates, systolic and diastolic pressures, length of A-B interval of the oxyhemogram during the 17-day period, and changes in motor and vestibular reactions.

1147
Soto Rojas, G.,
and C. Márquez
SOME FEATURES OF PULMONARY INSUFFICIENCY AT HIGH ALTITUDES. —— Amer. Rev. Respir. Diseases, 85 (1): 25-29. Jan. 1962.

The results are tabulated of pulmonary function tests (spirometry, blood gas analysis, mixed venous and arterial carbon dioxide, acid-base balance, hematocrit, and alveloar and arterial oxygen tension) performed in 65 patients with chronic pulmonary insufficiency and in 20 normal subjects at the altitude of the Mexican plateau (Puebla, 7,080 feet above sea level).

1148
Tichauer, E. R.
OPERATION OF MACHINE TOOLS AT HIGH ALTITUDES.—Ergonomics (London), 6 (1): 51-73. Jan. 1963.

Numerous small machine shops are operated on the high plateaux and in the valleys of the Andean Mountain system in South America servicing the needs of the several million inhabitants of this region. However, the products of those workshops situated at high altitudes appear to be unduly expensive to manufacture and to lack accuracy in dimensions and quality of finish. Consequently, the manufacture of bicycle front axles was studied at three levels of altitude: sea level, 9000 ft., and 13,500 ft. Among those factors analyzed and studied were visual and tactile controls, the stance of the operator and the general dimensions of the work-place. After attention was given to the ergonomics of work-place layout, workshops located at extremely high altitudes could produce nearly as efficiently as enterprises situated at sea level, because the reduction in work stress compensated for the effects of hypoxia. At high altitudes as well as at sea level, the application of ergonomics created conditions where systems of predetermined motion times could be applied profitably to jobbing operations and in circumstances and environments where such systems had been previously found to be virtually inapplicable. The effects of altitude on pulse rates was studied and an empirical equation was derived relating the quotient "working-pulse/resting-pulse" to the partial pressure of oxygen in the ambient air. (Author's summary)

1149
Tribukait, B.
[THE EFFECT OF CHRONIC HYPOXIA EQUIVALENT TO 1000 - 8000 M. ALTITUDE ON THE ERYTHROPOIESIS IN RAT] Der Einfluss chronischer Hypoxie entsprechend 1,000-8,000 m Hohe auf die Erythropoiese der Ratte. — Acta physiologica scandinavica (Stockholm), 57 (1-2): 1-25. Jan.-Feb. 1963. In German, with English abstract (p. 1).

A device is described for the maintenance of constant low air pressure. Rats were held under hypoxia equivalent to 1,000-8,000 m. altitude for several months. Total hemoglobin was determined according to a modified alveolar CO-method. Total hemoglobin at sea level was about 0.75 g./100 g. body weight; it increased significantly at 1,000 m. and reached 1.1 g./100 g. body weight at 4,000 m. The maximum of 2.2 g./100 g. was reached at 6,000 m. The limit of survival was reached at 8,000 m. New levels of total hemoglobin were reached after 20 and 40 days at 5,000 m. and 6,000 m., respectively. An additional supply of iron had no effect. Hemoglobin per 100 ml. blood was 14, 19 and 26 g. at sea level, 4,000 m., and 6,000 m., respectively. Hematocrit was 45% at sea level, 60% at 4,000 m. altitude, and 85% at 6,000 m. altitude. Hemoglobin concentration parallels hematocrit values during hypoxia. Blood volume increased by 20-50% at 6,000 m. altitude, but plasma volume decreased by 10-20%. Hemoglobin per unit body weight decreased with increasing body weight in animals adapted to 5,000 m. and 6,000 m. altitude. Similarly, blood volume decreased at 6,000 m. The daily production of hemoglobin was calculated from the total hemoglobin and the assumed life span of 60 days for erythrocytes. It increased to 4-5 times the normal during the first two days regardless of degree of hypoxia, but thereafter was a function of the degree of hypoxia. (Author's abstract, modified)

1150
Tribukait, B.
[READAPTATION OF THE RAT WITH HIGH ALTITUDE POLYCYTHEMIA TO SEA LEVEL] Die Readaptation der höhenpolyzythämischen Ratte an Meereshöhe.—Acta physiologica scandinavica (Stockholm), 57 (4): 419-430. April 1963. In German, with English summary (p. 419).

Rats were submitted to hypoxia corresponding to 6,000 m. altitude for 40-50 days. The total amount of hemoglobin, blood volume, and relative blood values (hemoglobin concentration, hematocrit) had been studied in hypoxia and after transfer to normal oxygen pressure. Total hemoglobin increased during hypoxia by 150-200%, relative blood values by 100%, and blood volume by 25-50%, indicating the increase of oxygen capacity of the blood and the volume of the circulatory system. 30 days after transfer to normal oxygen pressure total hemoglobin, blood volume and relative blood values had returned to normal. Thereafter relative blood values showed a transient decrease, but not the total hemoglobin. Thus the blood volume increased again. Problems in connection with the hemoistatic regulation of erythropoiesis are discussed. The body weight decreased during hypoxia by about 15%. After the period of hypoxia the rate of increase in body weight was faster than that of animals of the same order and body weight. (Author's summary) (31 references)

1151
Tsivilashvili, A. S.,
and I. N. Cherniakov
THE EFFECT OF EXPLOSIVE DECOMPRESSION ON THE ANIMAL AND HUMAN BODY.—Military Medical Journal, 1961 (9): 91-95. Washington: U. S. Joint Pub. Research Serv., no. 12169 (CSO:1374-N), Jan. 26, 1962. (Avialable from Office of Technical Services, U. S. Dept. Commerce)
English translation of: Vliianie vzrynvoi dekompressii na organizm zhivotnykh i cheloveka.—Voenno-meditsinskii zhurnal (Moskva), 1961 (9): 65-69. Sept. 1961. In Russian.

Outstanding findings are summarized of research on the physiological effects of explosive decompression carried on in countries outside of the Soviet Union and satellite countries.

1152
Ulvedal, F.,
T. E. Morgan, R. G. Cutler, and B. E. Welch
RESPIRATORY FUNCTION STUDIES DURING PROLONGED EXPOSURE TO SIMULATED ALTITUDE WITHOUT HYPOXIA.—School of Aerosapce

Medicine, Brooks Air Force Base, Tex. (Task no. 793002). Technical Documentary Report SAM-TDR-63-31, May 1963. iii+8 p.

Respiratory function studies (total and timed vital capacity, maximum breathing capacity, and expiratory minute volume) were made during several space cabin simulator experiments at ground level and at simulated altitudes of 18,000 feet, 27,000 feet, and 33,500 feet. The duration of the experiments was from 14 to 30 days with a PO_2 from normal level to 243 mm. Hg. A reduction in forced vital capacity was noted throughout the experiments at simulated altitude with a prompt reduction at the onset of exposure. Timed vital capacity showed that the percentage of the forced vital capacity expired during the first second of effort was greater at 33,500 feet than at ground level with intermediate values at 27,000 feet and 18,000 feet, respectively. An increase in maximum breathing capacity was seen at altitude; the magnitude of the changes appears to be due to the increase in simulated altitude and the decreased density of the respired gas. The expiratory minute volume does not appear to change during exposure to altitude as compared with ground control. (Authors' abstract)

1153
Valdivia, E.,
and D. Ottensmeyer
HEMATOLOGICAL ALTERATIONS INDUCED BY SIMULATED HIGH ALTITUDE.—Pathologia et microbiologia (Basel), 26 (1): 44-52. 1963. In English.

Twenty-five normal guinea pigs were studied to determine the normal range of hematologic values. Eleven of them were exposed to experimental high altitude. Hematologic variations in the guinea pig exposed to high-altitude hypoxia are prompt and statistically significant. Hematocrit, hemoglobin, and erythrocyte levels increase rapidly for two weeks and then more slowly with homeostasis occurring between seven to ten weeks. Peripheral reticulocytosis is increased during the first fourteen days with peak values occurring on the sixth and seventh days. Slight but statistically significant macrocytosis and anisocytosis of erythrocytes occur. A significant increase of neutrophils is distinct in animals exposed to hypoxia. (Authors' summary)

1154
Verzár, F.
[FIFTEEN YEARS OF MOUTAIN CLIMATE RESEARCH BY THE STATION FOR CLIMATIC PHYSIOLOGY, ST. MORITZ-BAD] Fünfzehn Jahre Höhenklimaforschung der Klimaphysiologischen Station St. Moritz-Bad.—Schweizerische medizinische Wochenschrift (Basel), 93 (6): 251-253. Feburary 9, 1963. In German, with English summary (p. 252-3).

The work of the Station for Climatic Physiology, St. Moritz, Switzerland, is reviewed for the years 1947-1962. The paper is partly devoted to an analysis of the physiological functions which may be influenced by the altitude of 5,500 feet, and partly to an analysis of the climatic factors which may be responsible for these effects. Particular consideration is given to the composition of the air at that altitude, delineating the role of atmospheric condensation nuclei. (31 references)

1155
West, J. B.,
S. Lahiri, M. B. Gill, J. S. Milledge, L. G. C. E. Pugh, and M. P. Ward
ARTERIAL OXYGEN SATURATION DURING EXERCISE AT HIGH ALTITUDE. —Jour. Applied Physiol., 17 (4): 617-621. July 1962.

Arterial oxygen saturations were measured on six members of the Himalayan Scientific and Mountaineering Expedition, 1960-61, during a wintering period at 19,000 feet (5,800 m.; barometric pressure 380 mm. Hg.). The determinations were made by ear oximetry and by the analysis of venous blood from the heated hand during rest and exercise at work levels up to 1,200 kg.-m./minute. Expired gas volumes and gas concentrations were also measured. The average arterial oxygen saturation at rest was 67%, and at work levels of 300 and 900 kg.-m./minute it was 63 and 56%, respectively. Several readings of less than 50% saturation were recorded during severe exercise. The progressive fall in arterial oxygen saturation as the work level was raised occurred in spite of an increasing alveolar oxygen tension, and the resulting large alveolar-arterial oxygen differences can be explained by the diffusion limitations of the lung. (Authors' abstract)

1156
West, J. B.
OXYGEN TRANSFER BY THE LUNG AT HIGH ALTITUDE [Abstract].—In: International Congress of Physiological Sciences, 22 (Leiden, 1962), Proceedings, vol. 2, no. 297. Amsterdam [1962?].

During the Himalayan Scientific and Mountaineering Expedition, 1960-61, the diffusing capacity of the lung for carbon monoxide was measured at 19,000 feet (approx. 380 mm. Hg) at work levels of 300 and 900 kilograms/minute. A change in diffusing capacity of less than 20% was found compared with sea level values, and this could be wholly accounted for by the increased rate of reaction of carbon monoxide with hemoglobin due to hypoxia. Measurements of arterial oxygen saturation by ear oximetry gave an average resting value of 67% which fell to 63 and 56%, respectively, for the two work levels. Several readings of less than 50% saturation were recorded on severe exercise. The progressive fall in arterial oxygen saturation as the work level was raised occurred in spite of an increasing alveolar oxygen tension, and the resulting large alveolar-arterial oxygen differences can be explained by the diffusion limitations of the lung. (Author's abstract)

1157
West, J. B.
WORK LIMITATIONS AT VERY HIGH ALTITUDE [Abstract].—Jour. Physiol. (London), 167 (1): 14P. June 1963.

On the assumption that the maximal work level depends on the amount of oxygen transported by the blood to the muscles, the relative importance of various factors involved in oxygen transfer by the lung and blood were examined, using data collected with a bicycle ergometer at altitudes up to 24,400 ft. The calculations show that the diffusing capacity of the lung is an important limiting factor and, to a lesser extent, so are the cardiac output and the oxygen capacity of the blood under these conditions. An interesting feature of the analysis is that the oxygen cost of ventilation may become a significant component of the total oxygen consumption during maximal exercise at 24,400 ft. This may explain why the ventilation at maximal exercise at this altitude was about 125 liters/minute B.T.P.S. whereas it was about 200 liters/minute at 19,000 and 21,000 ft. (From the author's abstract)

1158
Wood, W. B.,
and L. H. Leve
VENTILATORY DYNAMICS UNDER HYPERBARIC STATES.—Arch. Environmental Health, 7 (1): 47-59. July 1963.

Maximum breathing capacity, timed vital capacity, and maximum sustained expiratory flow rates were measured on 11 male subjects utilizing first air, then helium-oxygen (80%-20%) as the respiratory medium at various levels of hyperbaric pressure up to 15 atmospheres absolute. Performance was compared with that obtained at 1 atmosphere absolute. The group was normal or better on all parameters of dynamic pulmonary function at 1 atmosphere absolute. Above this level the over-all effect was that of a marked decrease in all parameters measured.

1159
Woolley, D. E.,
S. M. Herrero, and P. S. Timiras
CNS EXCITABILITY CHANGES DURING ALTITUDE ACCLIMATIZATION AND DEACCLIMATIZATION IN RATS.—Amer. Jour. Physiol., 205 (4): 727-732. Oct. 1963.

Electroshock convulsions in rats at sea level and at natural and simulated high altitudes demonstrated a central nervous system (CNS) excitation during acclimatization and depression during deacclimatization. Excitation, shown by decreased minimal seizure threshold and by increased duration of tonic extension during maximal seizures was evident after one or two days exposure to 12,500 ft. and after two hours to 20,000 ft. CNS depression was shown by absence or shorter duration of tonic extension during maximal seizures and by a rapid rise in seizure thresholds. Increased excitability at altitude is probably due to hypoxia and hyperventiation-induced hypocapnia. The depression during deacclimatization is similar to that produced by hypercapnia and hyperoxia and suggests that CNS sensitivity to carbon dioxide and oxygen becomes altered during acclimatization. (Authors' abstract)

1160
Wünsche, O.,
and H. Hartmann
HYPERELECTROLYTAEMIA AND INTRAVASCULAR FORMATION OF GAS BUBBLES IN RAPID DECOMPRESSION—In: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 51-59. Oct. 1963. In English and German.

Albino rats premedicated with an electrolyte solution containing 0.4% $KHCO_3$, 0.2% CaI_2, and 0.2% $NaHCO_2$ showed fewer intravascular air bubbles after rapid decompression from 0 to 60,000 feet altitude than untreated controls. Air bubbles were observed in only 10 to 20% of the premedicated animals. The electrolyte solution caused an increase of the sodium, potassium, and calcium level in the serum as well as dehydration. It is suggested that the greater part of the air bubbles probably does not originate from gas liberated from the blood, but from air penetrating the vascular system from the alveoli. This can only be expected at a positive pressure of 80 mm. Hg within the alveoli. The observed decrease of the intravascular air bubbles may be due to dehydration leading to an increase of the osmotic pressure and viscosity of the blood. (Authors' summary)

e. Anoxia

[*Hyperoxia, Hypocapnia, etc. under 3-c*]

1161
Austen, W. G.,
P. A. Ebert, and L. J. Greenfield
MECHANISM OF CARDIAC ARREST IN ACUTE HYPOXIA.—Surgery, 53 (6): 784-791. June 1963.

The effects of peripheral hypoxia on the dog's heart were evaluated at various levels of cardiac oxygenation by the use of two separate extracorporeal circuits. Cardiac hypoxia of 10 minutes' duration induced during normal systemic oxygenation did not result in marked bradycardia or arrhythmia. Systemic hypoxia, however, caused moderate to severe bradycardia, nodal rhythm, and sometimes cardiac arrest even when normal myocardial oxygenation was maintained. These effects, which could be abolished by vagotomy, were more profound when systemic unsaturation was suddenly induced and were most deleterious if the heart was hypoxic as well. (Authors' summary)

1162
Barański, S.
EFFECT OF HIGH-ALTITUDE HYPOXIA ON ^{32}P-PHOSPHATE METABOLISM AND INCORPORATION INTO THE CENTRAL NERVOUS SYSTEM OF WHITE MICE. — Bulletin de l'Académie polonaise des sciences (Varsovie), Série des sciences biologiques, 10 (7): 275-282. 1962. In English.

Mice received a solution of P^{32}-labeled phosphate by intraperitoneal injection and were subjected to simulated altitudes of 8000-8500 meters in a decompression chamber for 6, 12, 24, and 48 hours and then sacrificed. Gross morphological examination showed cerebral hyperemia and edema. Histological sections of the brain revealed enlargement of vascular lumina and empty spaces around some vessels which may have been associated with edema. The increase in the amount of brain fluid was highest after 6 hours of hypoxia. Differences in cell structure, if any, were not discernible histologically from those of animals subjected to hypoxia for periods of 6, 12, and 24 hours, but from those of 48 hours. Radioautographic studies of the brain revealed that P^{32} incorporation in hypoxia was less marked when compared with controls. The diminished specific radioactivity of brain protein and nucleoprotein fractions in hypoxia may be explained by disturbances in the metabolism of these compounds. Tabulations and graphs representing cerebral radioactivity in hypoxia are included.

1163
Bietti, G. B.
[CLINICAL ASPECTS OF HYPOXIA IN AVIATION OPHTHALMOLOGY] Aspects cliniques de l'anoxie en ophtalmologie aéronautique.—Rivista di medicina aeronautica e spaziale (Roma), 26 (2): 215-222. April-June 1963. In French, with English summary (p. 220).

A review is presented of the effects of hypoxia on the visual apparatus, based on literature data and on experiments by the author and his collaborators. The following aspects are discussed: perceptual changes (visual acuity, visual field, stereoscopic vision, brightness and color perception, flicker fusion frequency), electroretinogram, oculocardiac reflex, circulatory effects, intraocular pressure, function of ocular muscles (pupillary, ciliary, and external muscles), nystagmus, and the somewhat disputed changes in the transparency of the ocular media. Many of the ocular alterations produced by hypoxia can be alleviated by oxygen breathing. (58 references)

1164
Boyer, D. R.
HYPOXIA: EFFECTS ON HEART RATE AND RESPIRATION IN THE SNAPPING TURTLE.—Science (Washington), 140 (3568): 813-814. May 17, 1963.

Thirteen snapping turtles, Chelydra serpentina, were kept in an animal chamber at 25° C. and were exposed to atmospheres containing 2 to 21% oxygen. Heart beat increased significantly below 10% oxygen, while oxygen uptake remained relatively constant at all levels of oxygen. The period of apnea between breathing cycles decreased with the increase of hypoxia. The high tolerance of low oxygen uptake during hypoxia can be explained by the turtles' anaerobic metabolism and strong compression phase during breathing.

1165
Brooks, C. M.,
M. K. Ang, and R. T. van Dam
AN EXPERIMENTAL STUDY OF SOME EFFECTS OF HYPOXIA AND RESPIRATORY ACIDOSIS ON THE MAMMALIAN HEART. — Japanese Heart Jour. (Tokyo), 3 (1): 34-45. Jan. 1962.

In the in situ dog heart, hypoxia induced by 10% oxygen ventilation produced an initial slight shortening of conduction time and a definite lowering of threshold (excitability increase). Ultimately a depression of ventricular excitability and A-V conduction occurred. Rapid induction of respiratory acidosis induced by 2-12.8% carbon dioxide-oxygen mixtures, caused an early temporary depression of ventricular diastolic excitability. When induction of acidosis was slow this depression was slight or absent and an enhancement was observed in some cases. The depressant actions of hypoxia and acidosis appeared to be counteracted, to some degree, by a compensatory mechanism; thus the state of ventricular excitability and A-V conduction at any instant seem to depend on the balance between two opposed mechanisms. The total refractory period of the ventricular myocardium was only slightly prolonged by hypoxia and respiratory acidosis, but more markedly by ammonium chloride administration. After termination of hypoxia, ventricular diastolic excitability returned readily to a normal level, whereas A-V conduction time remained lengthened for a much longer period. Refractoriness also was not very labile. The A-V conducting system appears less resistant to the depressant effect of hypoxia and acidosis than the ventricular myocardium. (Authors' summary, modified)

1166
Brown, Harold N.
OXYGEN AT WHAT ALTITUDE? — Inhalation Therapy, 7 (5): 10-12, 20-21. Oct. 1962.

[Previously published in: Air Facts, 22 (3): 19-27. March 1959. Oxygen dissociation chart not included.] The first evidence of hypoxia occurs at 5,000 feet in the form of diminished night vision. Oxygen should be used while flying above 5,000 feet at night. At 10,000 feet there is definite but undetectable hypoxia requiring the use of oxygen. At this altitude the blood oxygen saturation level is 90%, compared to 95% at sea level. At 14,000 feet, when the oxygen saturation drops to 84%, the symptoms are as follows: dimming of vision, hand tremor, clouding of thought and memory, and judgment errors. At 16,000 feet, when the blood oxygen saturation level drops to 77%, the individual becomes disoriented, belligerent or euphoric, and completely irrational. Between 18,000 and 20,000 feet, neurocirculatory collapse or primary shock occurs with loss of consciousness. At higher altitudes more profound shock occurs, and collapse or even death is possible. An outline of oxygen equipment is presented and an oxygen dissociation chart included.

1167
Cantrill, S.,
and R. J. Walsh
IRON ABSORPTION FROM THE INTESTINAL TRACT: THE INFLUENCE OF THE HAEMOGLOBIN CONCENTRATION AND OF HYPOXIA. — Australian Jour. Biol. Sci. (Adelaide), 40 (1): 31-36. Feb. 1962.

Rats were exposed to atmospheric air, 5% carbon dioxide, and 11% oxygen and dosed with Fe^{59}. The amount of iron absorbed in the intestinal tract did not significantly differ between exposure to atmospheric air or 5% carbon dioxide, but there was a significant increase in absorbed iron with exposure to 11% oxygen. It is speculated that hypoxia may act directly on the intestinal mucosal cell or through some intermediary mechanism.

1168
Cassin, S.
EFFECT OF HYPOXIA ON THE RATE OF OXYGEN CONSUMPTION OF NEWBORN, YOUNG, AND ADULT MICE AT VARIOUS ENVIRONMENTAL TEMPERATURES.—Univ. of Florida Medical Coll., Gainesville (Contract AF 41(609)-1553); issued by School of Aerospace Medicine, Brooks Air Force Base, Tex. (Tast no. 775801). Technical Documentary Report no. SAM-TDR-62-122, May 1963. iii+9 p.

Critical oxygen concentration (PO_2)—that is, PO_2 below the point at which oxygen consumption is reduced—was measured in newborn, 5-day-old, and adult mice. At thermoneutral environmental temperatures, the critical PO_2 of newborn was 85 mm. Hg; that of 5-day-old mice was 100 mm. Hg; and that of adults was 70 mm. Hg. When ambient temperature was lower than the thermoneutral point, the critical PO_2 was higher. The extra oxygen consumption used to combat the lowering of body temperature appeared to make the animal more vulnerable to hypoxia. Although the newborn mouse cannot resist hypothermia effectively, there was a slight increase in its oxygen consumption in response to mild hypothermia. Maximal oxygen consumption occurred at lower temperatures in the 5-day-old mouse than in the 1-day-old. Evidently, there is a rapid maturation of temperature-controlling mechanisms during growth. (Author's abstract) (25 references)

1169
Cassin, S.,
M. J. Beck, P. Travis, S. Sanders, and A. B. Otis
THE EFFECT OF CARBONIC ANHYDRASE INHIBITION IN EXERCISING RATS.—Univ. of Florida, Gainesville (Contract AF 41(609)-1553); issued by School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775801). Technical Documentary Report no. SAM-TDR-63-22, May 1963. iii+6 p.

A series of experiments was performed to ascertain the effect of carbonic anhydrase inhibition on the ability of rats to exercise in room air and in an atmosphere of 6% O_2. In separate experiments, it was first established that peak plasma concentrations of the inhibitor acetazolamide after intraperitoneal injection and peak PCO_2 values in subcutaneous gas pouches occurred concomitantly at about 60 minutes. Rats trained to run on treadmills were able to run as long as 5-1/2 to 6 hours at 0.46 mile per hour in room air whether carbonic anhydrase was inhibited or not. When exercised in 6% O_2, however, the animals in which carbonic anhydrase was inhibited ran 39% longer, on the average, than did control animals. The increase in ventilation, which is known to be induced during carbonic anhydrase inhibition, without consequent tissue hypocapnia and alkalosis, probably accounted for the improved exercise performance of inhibited animals in a low-oxygen environment. (Authors' abstract)

1170
Cheymol, J.,
and M. Freyss-Beguin
[EFFECT OF PROCAINE AND ITS DERIVATIVES ON THE RESISTANCE OF THE WHITE MOUSE SUBJECTED TO HYPOXIA] Action de la procaïne et de ses dérivés sur la résistance du rat blanc soumis à l'hypoxie. — Comptes rendus de la Société de biologie (Paris), 156 (4): 606-608. July 28, 1962. In French.

Survival time was measured in male rats subjected to hypoxic hypoxia in a decompression chamber at a simulated altitude of 12,000 m. Procaine and diethylaminoethanol administration had no protective effect against hypoxia. On the other hand, para-aminobenzoic acid had a definite protective effect. A study of the effects of the two isomers (ortho and meta) of the acid demonstrated that the position of the amine radical determines the protective activity.

1171
Cho, Y. W.,
P. M. Galletti, and L. Nelson
STUDIES OF MYOCARDIAL ACTOMYOSIN AND MYOSIN AFTER SHOCK, ACUTE HEMORRHAGE, ACUTE HYPOXIA, AND CARDIOPULMONARY BY-PASS. — Circulation, 27 (4, Part 2): 748-752. April 1963.

Acute hypoxia was produced in dogs by breathing an 8% oxygen mixture and the physicochemical properties of myocardial actomyosin and myosin were studied. During acute hypoxia, the myosin adenosinetriphosphatase activity was affected, but actin appeared to remain unaltered. These changes of actomyosin and myosin may cause insufficient energy utilization by the cardiac contractile system and thereby affect cardiac efficiency.

1172
Clark, R. E.,
I. Cristlieb, M. Sanmarco, R. Diaz-Perez, and J. F. Dammann
RELATIONSHIP OF HYPOXIA TO ARRHYTHMIA AND CARDIAC CONDUCTION HEMORRHAGE: AN EXPERIMENTAL STUDY. — Circulation, 27 (4, Part 2): 742-747. April 1963.

Several different groups of rats and dogs were rendered hypoxic and a histological examination was made of the area of the atrioventricular node and bundle of His in sections obtained from the hearts of these animals. Sixty-one per cent of rats aged two weeks or older developed arrhythmias and had hemorrhage. None of ten baby rats presented changes. A significantly small percentage of the hypoxic dogs, with comparable arrhythmias, developed hemorrhage. The importance of a possible species difference is suggested when attempts were made to correlate the results in rats, dogs, and humans.

1173
Cosby, R. S.,
E. C. Stowell, D. M. Morrison, M. Mayo, F. B. Ruymann, and B. Bernard
CONTINUOUS MEASUREMENT OF ALVEOLO-ARTERIAL GRADIENTS AT AMBIENT AND ANOXIC LEVELS. — Jour. Applied Physiol., 17 (1): 1-5. Jan. 1962.

In 18 normal subjects continuous alveolo-arterial differences were measured at decreasing levels of inspired oxygen tension from ambient to 12% oxygen. A mean difference of 12.1 mm. Hg decreased gradually to virtual obliteration of the gradient at low levels of inspired oxygen tension. The response of arterial oxygen tension to an anoxic level, though maximal in the first minute (74% of the total change in 4 minutes), continued to change at the rate of 2 1/2% per minute during and after the 4th minute. Continuously changing levels of ventilation and arterial oxygen tension and carbon dioxide tension, as described, make it unlikely that the steady state is ever truly present during acute exposure to anoxia. (From the authors' abstract)

1174
Dagianti, A.,
and E. Busnengo
[ON THE HEMODYNAMIC BEHAVIOR OF THE SYSTEMIC AND PULMONARY CIRCULATION IN THE DOG DURING INTERMITTENT CHRONIC HYPOXIA] Sul comportamento dell'emodinamica del grande e del piccolo circolo nel cane in ipossia cronica discontinua.—Rivista di medicina aeronautica e spaziale (Roma), 26 (2): 236-245. April-June 1963. In Italian, with English summary (p. 243).

It has been known that acute exposure to anoxia results in pulmonary hypertension. The authors subjected five dogs to a simulated altitude of 5000 m. (arterial hemoglobin about 80%) for 8 hours a day on 45 consecutive days. Pulmonary arterial pressure was measured in the right heart and systemic pressure in the aorta. By the end of the experimental period the pulmonary pressure was found to be essentially unchanged, the pulmonary vascular resistance was decreased, and the blood flow through the lung correspondingly increased. In the systemic circulation, however, the blood pressure was slightly increased in spite of a moderate decrease in vascular resistance. Under the conditions of the experiments, therefore, the pulmonary circulation of the dogs had adapted well to intermittent hypoxia. (41 references)

1175
De Nicola, P.,
P. Rosti, F. Corbetta, and G. Maggi
[RESEARCH ON ERYTHROCYTE AGGREGATION IN THE SMALL VESSELS IN PROFESSIONAL PATHOLOGY. III. MODIFICATIONS DETERMINED BY THE STATE OF EXPERIMENTAL HYPOXIA] Ricerche sull'aggregazione eritrocitaria nei piccoli vasi in patologia professionale. III. Modificazioni determinate dagli stati di ipossia sperimentale. — Folia medica (Napoli), 45 (1): 21-32. Jan. 1962. In Italian, with English summary (p. 31).

The blood in small conjunctival blood vessels was studied parallel to oxymetric changes in normal persons between 19 and 60 years of age breathing a 10% oxygen mixture. During hypoxia, the onset of erythrocyte aggregation was observed until the appearance of "sludge" which reached a peak 8-10 minutes after the test began. These changes persisted for 10-12 minutes after return to normal breathing.

1176
Dereymaeker, A.,
F. Theeuwissen-Lesuisse, N. P. Buu-Hoï, and C. Lapière
[EXPERIMENTAL CEREBRAL ANOXIA: PROTECTIVE EFFECT OF THE DERIVATIVES OF p-CHLOROPHENOXYACETIC ACID] L'anoxie cérébrale expérimentale: effet protecteur des dérivés de l'acide p-chlorophénoxyacétique. — Medicina experimentalis (Basel), 7 (4): 239-244. 1962. In French, with English summary (p. 244).

A number of analogs and derivatives of p-chlorophenoxyacetic acid were investigated in rabbits rendered anoxic by nitrogen breathing, with electroencephalographic control. p-Chlorophenoxyacetic acid, its bromide and fluoride analogs, and its dimethylaminoethyl ester were effective in protecting the rabbit brain against nitrogen-induced anoxia. However, p-methoxyphenoxyacetic acid was not effective. The mechanism of the protective activity was not analyzed, but it appears to involve a modification of respiratory exchanges. (Authors' summary, modified)

1177
Dietz, H. W.
LOWER-NEPHRON NEPHROSIS FOLLOWING ACUTE HYPOXIA. — Jour. Occupational Med., 4 (9): 490-491. Sept. 1962.

Two men in the course of their work entered a confined space in which the air had been displaced by vaporized liquid nitrogen. The one who was exposed for the shorter time recovered promptly. In the other, a lower-nephron nephrosis with oliguria developed and persisted for 8 days. This man was treated by means of strict regulation of fluid balances as well as measures to attempt maximal decrease in protein metabolism and in serum potassium level. The patient showed gradual but definite clinical improvement and was discharged after 58 days' hospitalization. (From the author's summary)

1178
Dobrinskaia, M. A.,
and Kh. M. Rubina
[LACTIC DEHYDROGENASE ACTIVITY IN TISSUES AND BLOOD OF RATS UNDER NORMAL CONDITIONS AND DURING HYPOXIA] Izuchenie aktivnosti laktikodegidrogenazy v tkaniakh i krovi krys v norme i pri gipoksii.—Voprosy meditsinskoi khimii (Moskva), 9 (3): 279-282. May-June 1963. In Russian, with English summary (p. 282).

Colorimetric determinations of lactic dehydrogenase concentration were made in blood, liver, and muscles of rats exposed to a simulated altitude of 9,500-10,000 meters. Under normal conditions the concentrations in blood, liver, and muscles were 215±8, 5000±200, and 2000±50 micromoles, respectively, while during hypoxia the corresponding values were 310±9, 4800±150, and 2050±50 micromoles.

1179
Dokukin, A. V.,
Z. S. Konstantinova, IU. S. Chechulin, and IU. V. Bukin
[THE EFFECT OF VITAMIN B_{15} (PANGAMIC ACID) ON THE GENERAL AND CARDIOVASCULAR TOLERANCE TO HYPOXIA] Deistivie vitamina B_{15} (pangamova' kisloty) na ustoichivost' organizma i ego serdechno-sosudistoi sistemy k gipoksii.—Doklady Akademii nauk SSSR (Moskva), 144 (3): 675-677. 1962. In Russian.

The survival rates of mice exposed to asphyxia after preliminary administration of vitamin B_{15} were higher than those of controls. Cats exposed to acute hypoxia after vagotomy and ligation of the left coronary vein developed fibrillation and arrhythmia later than controls, if previously treated with vitamin B_{15}. The vitamin treatment of dogs with induced cardiac ischemia after exposure to hypoxia produced an incomplete restitution of electrocardiograms.

1180
Downing, S. E.,
J. H. Mitchell, and A. G. Wallace
CARDIOVASCULAR RESPONSES TO ISCHEMIA, HYPOXIA, AND HYPERCAPNIA OF THE CENTRAL NERVOUS SYSTEM. — Amer. Jour. Physiol., 204 (5): 881-887. May 1963.

The hemodynamic responses to perfusing the central nervous system with hypoxic or hypercapnic blood were observed in the dog. A dual, rotating disc oxygenator system was employed to separately perfuse the brachiocephalic artery following bilateral carotid sinus area denervation. An increase of blood pressure, peripheral vascular resistance, heart rate, and atrial and ventricular contractility were produced by lowering the oxygen tension or raising the carbon dioxide tension of the central nervous system perfusate. The hemodynamic findings were similar to those observed during systemic hypoxia. It is, therefore, suggested that the gas composition of the blood perfusing the central nervous system may importantly influence the response of the organism to systemic hypoxia. (Authors' abstract, modified)

1181
Egorov, A. S.
[ON THE ADAPTATION OF ATHLETES TO HYPOXEMIA IN REPEATED BREATH-HOLDING EFFECTED BY A VOLUNTARY EFFORT] Ob adaptatsii sportsmenov k gipoksemii pri povtornykh zaderzhkakh dykhaniia v sviazi s razlichnoi napravlennost'iu soznaniia. — Voprosy psikhologii (Moskva), 8 (5): 84-90. Sept.-Oct. 1962. In Russian, with English summary (p. 90).

Forty test subjects participated in four series of experiments. These consisted of 10 periods of breath-holding per person per single test. The experiments were conducted under various conditions: the subjects were either not influenced mentally, or had a mathematical problem to solve, or were conditioned by antagonistic motivation, or by positive emotion. There was a definite influence of the frame of mind on the organism's adaptability to hypoxemia which resulted in either an increase or a decrease of adaptation. Such influences should be interpreted in terms of conditioned-reflectory shifts in response to verbalization and direct signals. This makes it possible to speak of a psychological adaptation to hypoxemia, i.e., of a physiological effect which influences the economy of oxygen consumption.

1182
Fedorova, K. N.
[THE EFFECT OF PRESSOR AND DEPRESSOR SUBSTANCES ON SYSTEMIC AND PULMONARY CIRCULATION IN HYPOXIC HYPOXIA] Vliianie pressornykh veshchestv na krovoobrashchenie v bol'shom i malom kruge pri gipoksicheskoi gipoksii. — Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 53 (2): 31-36. Jan. 1962. In Russian, with English summary (p. 36).

A study was made of the effect of adrenaline (0.7 γ/kg.), acetylcholine (5-10 γ/kg.), and serotonin (10-15 γ/kg.) administration on the systemic and pulmonary circulation in hypoxia with and without hypocapnia. Thirty-eight anesthetized and tracheotomized dogs were ventilated with (a) 10% O_2 in N_2, (b) 4-5% O_2 in N_2, and (c) a mixture of 4-5% O_2, 1-3% CO_2, and N_2. Hypoxia potentiated the depressor reaction of acetylcholine on systemic circulation and tachycardia. Elimination of hypocapnia intensified the depressor effect of acetylcholine and to a lesser degree the heart rate. Sensitivity to adrenaline and serotonin was decreased in hypoxia. The pressor reactions to adrenaline administration were augmented by hypoxia, and after elimination of hypocapnia reached the control levels in a number of cases. It is concluded that lowered sensitivity to adrenaline in hypoxia is primarily due to accompanying hypocapnia.

1183
Fowler, K. T.,
and J. Read
EFFECT OF ALVEOLAR HYPOXIA ON ZONAL DISTRIBUTION OF PULMONARY BLOOD FLOW. — Jour. Applied Physiol., 18 (2): 244-250. March 1963.

Redistribution of pulmonary blood flow was studied by means of the cardiogenic oscillations of expired gas tensions in six normal subjects after induction of alveolar hypoxia (13.5% O_2 inspired). In three subjects the upper zones of the lungs were found to receive a considerably greater proportion of total pulmonary blood flow during hypoxia in both vertical and horizontal postures. Two subjects showed no redistribution in either position. The response of one subject was intermediate between these two groups. It is concluded that in some subjects there is no pulmonary vascular response to alveolar hypoxia, whereas in others there is a response consisting of preferential lower-zone vasoconstriction of greater or lesser magnitude. Earlier data on the effects of hypoxia on the pulmonary circulation are shown to be consistent with the operation of this mechanism. (Authors' abstract)

1184
Fregly, M. J.
EFFECT OF CHRONIC EXPOSURE TO HYPOXIA ON BLOOD PRESSURE AND THYROID FUNCTION OF HYPERTENSIVE RATS.—Univ. of Florida Coll. of Medicine, Gainesville (Contract AF 41(657)-370); issued by school of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775801). Technical Documentary Report no. SAM-TDR-63-4, March 1963. iii+8 p.

Chronic exposure to an atmosphere containing 13% oxygen protects against development of renal hypertension in rats. The mechanism through which the rats are protected may involve the thyroid gland since certain criteria for assessment of thyroid function, using radioactive iodide, suggest depression of activity. Other physiologic mechanisms, brought into play as a result of hypoxia, may also contribute and need to be studied. (Authors' abstract)

1185
Gömöri, P.,
S. Munkácsi, Z. Nagy, L. Takács, and K. Kállay
ISCHAEMIA AND ARTERIOVENOUS ANASTOMOSES OF THE KIDNEY IN SHOCK, HAEMORRHAGE, DEHYDRATION AND ARTERIAL HYPOXIA IN DOGS.

— Acta medica Academiae scientiarum hungaricae (Budapest), 18 (1): 119-125. 1962.

A study of the renal circulation was made in dogs by means of the corrosion preparation method using 5% polyvinyl chloride (PVC) dissolved in cyclohexanone-acetone mixture. The PVC fills only the arterial system of the kidney, the glomeruli becoming well filled without filling of the postglomerular capillaries of the venous system. In most cases, arterial hypoxia produced by inhalation of 8-10% oxygen-nitrogen mixture, and dehydration produced by pylorus ligation, revealed a severe lack of filling (ischemia) of the renal arteries and glomeruli. The opening of arteriovenous anastomoses was observed under the stereomicroscope. The results prove the existence of ischemia and the development of shunts in dehydration and arterial hypoxia. (Authors' abstract, modified)

1186
Gordon, I. B.,
and L. N. Katz
HYPOXIA AND THE PULMONARY VASCULATURE. — Perspectives in Biol. and Med., 5 (3): 275-292. Spring 1962.

A review of the literature and an analysis and synthesis of information is presented concerning the mechanism by which hypoxia induces pulmonary hypertension. Methods of instrumentation and techniques for inducing hypoxia are analyzed. Studies on cats, dogs, and humans are presented separately. Pulmonary arterial hypertension seems to be initiated by an area of the pulmonary vasculature, and in cats and dogs vasoconstriction seems to occur in a post-capillary area. The area of vasoconstriction in humans is not known with certainty. Clinical conditions such as breathing at high altitude and hypoxia produced by various respiratory diseases are discussed as to their relationship to hypoxemia. (30 references)

1187
Gorozhanin, L. S.
[AGE-RELATED CHANGES IN THE MORPHOLOGICAL COMPOSITION OF THE BLOOD IN DOGS DURING HYPOXIA] Vozrastnye osobennosti izmenenii morfologicheskogo sostava krovi pri gipoksii u sobak. — Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 53 (5): 22-24. May 1962. In Russian, with English summary (p. 24).

Hypoxia was induced in 17 dogs of various ages by exposing them for 40 minutes to reduced atmospheric pressure (267 mm. Hg) in the barochamber. Hypoxia had no effect on the blood morphology in puppies less than two months old. During the third month puppies developed reactions characteristic of the adult animals, namely an increase in the number of erythrocytes, a rise in the hemoglobin content, and fluctuations of the leukocyte count.

1188
Hamberger, A.,
and H. Hydén
INVERSE ENZYMATIC CHANGES IN NEURONS AND GLIA DURING INCREASED FUNCTION AND HYPOXIA. —Jour. Cell Biol., 16 (3): 521-525. March 1963.

Moderate hypoxia produced by subjecting rabbits to 8% oxygen mixtures for about 15 hours caused an increase in the ribonucleic acid content and cytochrome oxidase activity in the cells of Dieters' nucleus. The enzyme activity of the glia did not change. Hypoxia effected a marked increase of the anaerobic glycolysis of the nerve cells and a slight increase of that of the glia cells. Included are representative tables.

1189
Hoeschen, R. J.,
L. H. A. Gold, T. E. Cuddy, and R. M. Cherniack
OXYGEN COST AND EFFICIENCY OF RESPIRATORY SYSTEM IN HYPOXIA AND IN CONGESTIVE HEART FAILURE. — Circulation Research, 11 (5): 825-831. Nov. 1962.

The oxygen cost of increased ventilation rose, and the efficiency of the respiratory system fell in nine normal subjects breathing a hypoxic gas mixture. This increased ventilation was apparently due to a decrease in the efficiency with which added inspiratory work loads were handled for there was no change in the total mechanical work of breathing.

1190
Jacobs, G.
[METABOLITE CONTENTS OF THE LUNG AND THEIR CHANGES DURING ABSOLUTE ANOXIA] Über den Metabolitgehalt der Lunge und seine Veränderung im absoluten Sauerstoffmangel. — Zeitschrift für die gesamte experimentelle Medizin (Berlin), 137 (1): 12-16. 1963. In German.

Determinations were made of the lung concentrations of adenosine triphosphate (ATP), adenosine diphosphate (ADP), adenosine monophosphate (AMP), glucose, glycogen, lactic acid, inorganic phosphate, and phosphocreatin in rabbits ventilated with air or pure nitrogen for 7.5-45 minutes. Anoxia for 7.5 minutes produced a decrease in ATP concentration to 1/2 the normal value, a 2-3-fold increase in ADP and AMP, a decrease in glycogen to 1/3 the original value, a slight decrease in glucose, and 2-fold increases in lactic acid and inorganic phosphate. Phosphocreatin was not found in either normal or anoxic lungs. Concentration of ATP, ADP, AMP, and glycogen were essentially the same after 7.5 and 45 minutes of anoxia. Inorganic phosphate and lactic acid concentrations continued to increase with longer durations of anoxia, and glucose continued to decrease. The blood content of the lungs was increased 2.5 times after 7.5 minutes of anoxia, when circulatory arrest occurred.

1191
Jendykiewicz, Z.,
W. Rożynek-Łukanowska, G. Straburzyński, and S. Szulc
[GLUTATHIONE AND ASCORBIC ACID SHIFTS IN HYPOTHERMIA AND ASPHYXIA] Glutathion- und Ascorbinsäureverschiebungen bei Hypothermie und Asphyxie. — Pflügers Archiv für die gesamte Physiologie (Berlin), 274 (5): 528-532. 1962. In German.

Hypothermia of 25-28° C. rectal temperature raised the ascorbic acid content in blood, muscle, and liver tissues of guinea pigs without any change in the glutathione content of these tissues. Further lowering of the body temperature to 16-20° C. increased the glutathione content in blood and muscle tissue while simultaneously decreasing its concentration in liver. These shifts in glutathione distribution are the same as those noted in animals during acute asphyxia which suggests their origin to be asphyxia due to depressed respiration in deep hypothermia. The liver is presumed to be the source of the glutathione supply and the adrenal glands the source of the ascorbic acid supply to muscles and blood. (Authors' summary, modified)

1192
Jones, N. L.,
S. Lal, and A. Naimark
THE EFFECT OF ACUTE HYPOXIA ON VENTILATION AND ARTERIAL LACTATE AND PYRUVATE LEVELS DURING MODERATE EXERCISE IN MAN [Abstract].—Jour. Physiol. (London), 167 (1): 20P. June 1963.

In exercise breathing air ($P_{a,o2}$ 90-102 mm. Hg; V_{o2} 1.50-1.65 liters/minute) a linear relation was observed between ventilation and the level of arterial lactate, "excess" lactate or the lactate:pyruvate ratio. In hypoxic exercise ($P_{a,o2}$ 25-42 mm. Hg) at the same work load both ventilation and excess lactate increased. There was a good correlation between the change in ventilation and the change in excess lactate. In two subjects the relation between ventilation and anaerobic metabolism was demonstrated at several work loads. The ventilatory depression produced by single inspirations of oxygen during hypoxic exercise was not great enough to account for the total difference between normoxic and hypoxic ventilation. These findings are in agreement with those of others and do not support the view that sensitization of the arterial chemoreceptors to hypoxia itself is sufficient to explain entirely the ventilatory response to hypoxia during exercise. Prolonged oxygen administration during hypoxic exercise confirmed the presence of slow changes in ventilation which were paralleled by a decline in excess lactate although total lactate did not always change appreciably. (From the authors' abstract)

1193
Kirchoff, H. W.
[COMBINED STUDIES OF CIRCULATION AND RESPIRATION UNDER VARIOUS OXYGEN CONCENTRATIONS] Examens combinés de la circulation et de la respiration sous diverses concentrations d'oxygène. —Revue de médecine aéronautique (Paris), 2 (8): 463-466. Aug.-Sept. 1963. In French.

In order to clarify the relationship between cardiac and respiratory functions, measurements of respiratory quotient, respiratory volume per minute, blood pressure, and electrocardiogram have been made at oxygen concentrations of 8, 10, 12, 14, and 21% with return to 21% oxygen after mixtures of 8 to 14% oxygen. In normal subjects, no obvious changes occur in mixtures of 10 to 21% oxygen. In 8% oxygen, there is a 30 to 50% increase in respiratory volume, tachycardia occurs, and blood pressure increases.

1194
Kovalenko, E. A.,
and V. B. Malkin
[AN INVESTIGATION OF BIOELECTRICAL ACTIVITY AND OXYGEN TENSION IN THE BRAIN TISSUES DURING HYPOXIA] Izuchenie biopotentsialov i napriazhenie kisloroda v tkaniakh mozga pri gipoksii.—Problemy kosmicheskoi biologii (Moskva), 1: 427-437. 1962. In Russian, with English summary (p. 437).

Dogs and rabbits were treated with a gas mixture containing 1-1.5% oxygen. The test animals revealed a two-phase change in the electroencephalographic recordings: The first phase consisted of slow high-voltage waves of gradually increasing amplitude; the second, of a sharp drop in the amplitude and frequency of the electroencephalographic waves and of a general depression of the electrical activity of the cerebrum. The electrocardiograms revealed the onset of simple tachycardia for brief periods followed by a gradual inhibition of the cardiac rhythm with characteristic terminal changes. No correlation was noted between the onset of EEG responses and the level of oxygen tension in the cerebral tissues. In general, the slow waves appeared when the oxygen tension was lowered to 46%-20% in the cortex and to 44%-28% in the subcortical tussues. Restitution of activity occurred when the oxygen tension was 35%-40% in the cortex and 45%-50% in the subcortical tissues. It is concluded that the hypoxic changes in the brain depend not only upon the level of oxygen tension but also upon the duration of exposure.

1195
Kuida, H.,
Arthur M. Brown, J. L. Thorne, R. L. Lange, and H. H. Hecht
PULMONARY VASCULAR RESPONSE TO ACUTE HYPOXIA IN NORMAL, UNANESTHETIZED CALVES. —Amer. Jour. Physiol., 203 (2): 391-396. Aug. 1962.

Gas mixtures of 10-16% O_2 in N_2 were administered to normal unanesthetized calves through an endotracheal tube, for periods averaging 7 minutes, 22 times during 19 studies in 15 animals. Cardiac catheterization and dye dilution techniques were used to measure arterial and mixed venous blood gas composition, pulmonary (PAP) and carotid arterial (CAP) pressures, and cardiac output (CI) before, during, and occasionally after hypoxia. Pulmonary artery wedge pressure was measured in some animals and did not change. Changes in calculated pulmonary vascular resistance (PVRI) were assessed to infer alterations in vascular tone. Mean changes of various parameters were as follows: Arterial oxygen tension, $-30 \pm 4\%$; CI, $+1.57 \pm 0.5$ liters/min./m.^{2}; PAP, $+12.7 \pm 2$ mm. Hg; PVRI, $+0.7 \pm 0.3$ mm. Hg/liter/min./m.^{2}. All were statistically significant at the 5% level. The relative increment in PAP was three times greater than in CI. It is concluded that hypoxia produces pulmonary vasoconstriction in these animals. The magnitude of the response is greater than has been observed in previous studies on intact unanesthetized animals of other species. (From the authors' abstract)

1196
Kunzmann, H.
[THE DIFFERENT BEHAVIOR OF THE "ALKALI RESERVE" IN ANOXIA] Les divers comportements de la "réserve en alcali" en manque d'oxygène.— In: Vorträge der Mitarbeiter des Instituts für

Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 28-33. Oct. 1963. In French and German.

When 35 persons were subjected to anoxia, 30% showed a simultaneous increase in the bicarbonate and carbonic acid content of the blood while the other 70% followed the rule that anoxia is associated with decreased bicarbonate and carbonic acid in the blood. In the transformation of oxyhemoglobin to hemoglobin a base is released which results in increased bicarbonate and a decrease in the partial pressure of carbon dioxide and the carbonic acid content.

1197
Lance, J. S.,
and H. Latta
HYPOXIA, ATELECTASIS AND PULMONARY EDEMA. —— Arch. Pathol., 75 (4): 373-377. April 1963.

Adult rats subjected to hypoxia (4-5% O_2) for 24 hours in a closed box with a controlled constant flow of oxygen had lung weights significantly heavier than those of control animals. The increase was more marked in the animals dying during a 24-hour period than in those surviving a full day. The increase amounted to nearly one-third of the average normal lung weight, and although no histological differences between hypoxic and control lungs were detected, it is suggested that subtle edema and probably hyperemia were responsible for the increased weight. Pulmonary edema was frequent in newborn rats dying during hypoxia. These results indicate that prolonged hypoxia in the newborn and the adult favors the production of atelectasis and of pulmonary edema, but this alone is not sufficient to produce hyaline membranes. Nor does the direct introduction into the lung of fresh blood plasma without clotting inhibitors suffice to produce hyaline membranes. Additional factors, possibly both intrinsic and extrinsic, seem to be necessary. (Authors' summary, modified)

1198
Levy, J. V.,
and V. Richards
EFFECT OF OXYGEN AT HIGH PRESSURE (OHP) ON ASPHYXIAL SURVIVAL TIME OF RATS. —— Proc. Soc. Exper. Biol. and Med., 109 (4): 941-944. April 1962.

The effects of combining pressure oxygenation at 3 atmospheres with hypothermia (20° C.) on asphyxial survival of rats following tracheal occlusion have been studied. Exposure to 100% oxygen at high pressure (OHP) without hypothermia increased survival times about 55-80% over those seen in animals breathing 100% oxygen at ambient temperature and pressure. Oxygenation at 3 atmospheres combined with hypothermia at 20° C. gave maximal prolongation of survival, although this was not significantly greater than seen with hypothermia alone. Addition of carbon dioxide to the inspired oxygen under pressure also afforded additional protection, even in absence of hypothermia. The action of OHP and hypothermia in increasing survival is additive rather than synergistic. (Authors' summary)

1199
Lim, T. P. K.,
and U. C. Luft
INFLUENCE OF HYPOXIA ON THERMAL HOMEOSTASIS IN MAN. —— Lovelace Foundation for Medical Education and Research, Albuquerque, New Mexico (Contract AF 41(657)-330); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-20). Technical Documentary Report no. AAL-TDR-61-55, June 1962. iv+20 p.

The influence of induced hypoxia on core and shell temperatures, metabolic rate, perspiration, and other related cardiopulmonary parameters has been studied in six healthy subjects under neutral, cold, and warm environmental conditions. Mean skin temperatures in all three thermal environments with room air breathing are not different from those in similar environmental conditions with hypoxia. Rectal temperature during hypoxia is not different from that during room air breathing in neutral and cold environments. However, this is not true in a warm environment, when rectal temperature is significantly higher during hypoxia than that during room air breathing. The mechanism of this phenomenon cannot be explained on the basis of thermal balance alone. No great influence of hypoxia on shivering or perspiration can be detected under the experimental conditions. The synergistic actions of hypoxic and thermal stresses on total ventilation and heart rate are demonstrated. (From the authors' abstract)

1200
Lim, T. P. K.,
and U. C. Luft
THE EFFECT OF INDUCED HYPOXIA ON THERMOREGULATION AND CARDIOPULMONARY FUNCTION.—Lovelace Foundation, Albuquerque, New Mexico (Contract AF 41(657)-330); issued by Arctic Aeromedical Lab., Fort Wainwright Alaska (Project no. 8238-20). Technical Documentary Report no. AAL-TDR-62-19, Jan. 1963. iii+46 p.

The effect of induced hypoxia on body temperature regulation and cardiopulmonary function is assessed in anesthetized dogs under warm, neutral, and cold environments. Hypoxia acts differently to heat conservation (shivering) and heat dissipation (thermal panting) mechanisms: the former is suppressed, while the latter is facilitated. It is also found that the suppression of shivering is partly due to the hypocapnia which is produced under hypoxia. The lethal threshold of acutely induced hypoxia is at the inspiratory O_2 level of approximately 3 per cent in the neutral and cold environments, whereas it is at 5 per cent in the warm environment. Under hypoxia, the total ventilation is increased two- to threefold. The alveolar ventilation, however, is augmented to a lesser degree with a progressive increase in physiological dead space. Contrary to respiration, the cardiac output is only slightly increased (less than 30 per cent over the control value) under hypoxia. (Authors' abstract)

1201
Lolley, R. N.,
and F. E. Samson
CEREBRAL HIGH-ENERGY COMPOUNDS: CHANGES IN ANOXIA. —— Amer. Jour. Physiol., 202 (1): 77-79. Jan. 1962.

Acid-soluble phosphates of rat brain during anoxia were determined by ion-exchange and chemical procedures. There is a general shift during anoxia of triphosphate nucleotides to monophosphates and a very rapid breakdown of phosphorylcreatine. However, total phosphate leaving the high-energy phosphate pool is not equal to the changes in inorganic phosphate; inorganic phosphate change is much larger than high-energy phosphate change in early anoxia and much smaller in extended anoxia. The patterns of guanosine triphosphate and uridine triphosphate changes are more complex than adenosine triphosphate changes. Nicotinamide-adenine dinucleotide levels are steady until late anoxia, at which time they decrease slightly. Cytidine monophosphate is the only cytidine nucleotide detected. Inosine nucleotide concentrations in control animals were below the limit of the method, but in late anoxia inosine monophosphate appeared. The data show that the energy flow through the phosphates in brain is rapid and involves phosphate compounds other than the acid-soluble nucleotides and phosphoryl-creatine. (Authors' abstract)

1202
Malkin, V. B.,
and A. F. Iurkov
[THE RESISTANCE OF ADRENALECTOMIZED AND HYPOPHYSECTOMIZED RATS TO ACUTE OXYGEN DEFICIENCY] Ob ustoichivosti adrenalektomirovnnykh i gipofizektomirovannykh krys k ostromu kislorodnomy golodaniiu.—Problemy kosmicheskoi biologii (Moskva), 2: 393-398. 1962. In Russian, with English summary (p. 398).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 401-406. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 36-21437)

A study was made of the resistance of albino rats to acute oxygen deficit during ascent to altitudes of 11,000-12,000 m. in a low-pressure chamber. The degree of hypoxia was determined on the basis of EEG changes, respiration, electrocardiogram, and survival time. After adrenalectomy the survival time of these animals decreased. Hypophysectomy increased the resistance to hypoxia to an insignificant degree. This is cited as proof for the opposite influence of hypophysectomy and adrenalectomy on the animal resistance to hypoxia. The data obtained are at variance with Selye's theory. (From the authors' summary)

1203
Margaria, R.,
P. Cerretelli, and U. Bordoni
THE REGULATION OF PULMONARY VENTILATION IN ACCLIMATIZATION TO ALTITUDE.—Revue de médecine aéronautique (Paris), 1 (2): 112-113. Dec. 1961-Jan. 1962. In English

Also published in: Indus. Med. and Surg., 32 (1): 9-10. Jan. 1963.

Three nonacclimatized subjects ingested ammonium chloride and were exposed to hypoxia. Hyperventilation was elicited by a chemoreflexogenic mechanism. Hyperventilation induced alkalosis, which tended to depress ventilation. The alkali excretion mechanism then removed the alkalosis, bringing the ventilation values to a higher level. At the end of this process a new steady state was reached. The removal of hypoxia did not bring the ventilation values down to the starting level, but to higher values characteristic of an acidosic subject. Hyperventilation presented by man acclimatized to hypoxia when returning to a normoxic state is explained by the different acid-base conditions of the blood, i.e., by the acidosic state developed during the process of acclimatization as a consequence of renal alkali excretion.

1204
Marinacci, A. A.,
and C. B. Courville
CHANGES IN THE ELECTROENCEPHALOGRAM PRODUCED BY CEREBRAL ANOXIA.—Bull. Los Angeles Neurol. Soc., 28 (2): 70-78. June 1963.

Changes in the brain wave pattern which accompany cerebral anoxia are reviewed. Incident to circulatory fluctuations in the early stage of cerebral hypoxia, such changes are the result of abnormal physiological reactions of the cortex. In the later stages, abnormal brain waves probably result from actual pathological changes in the cortex. The electrical activity of the cerebral cortex reflects closely whether the change is physiological, pathological, borderline, or profound. In acute cerebral hypoxia, a mixture of gases low in oxygen content produces the most characteristic fluctuating changes in the brain waves. These changes can be traced sequentially from normal wave activity to slight slowing to extreme slowing of wave activity and, finally, to electrical silence. Inhalation of oxygen frequently reverses this process. Electroencephalograms in acute cerebral anoxia of any type are an invaluable tool in assessing the prognosis or the degree of brain damage. Serial electroencephalograms after acute anoxia are recommended as a help in prognosis. Full recovery from acute cerebral anoxia is indicated only when the patterns of the brain waves show no fluctuation and have returned to normal. (Authors' summary, modified)

1205
Mazzella, G.
[SOME HEMATOLOGICAL VARIATIONS WHICH OCCUR IN DISCONTINUOUS CHRONIC HYPOXIA: CYTOMORPHOLOGIC AND CYTOCHEMICAL STUDY] Su alcune variazioni ematologiche che intervengono in ipossia cronica discontinua: Studio citomorfologico e citochimico.—Rivista di medicina aeronautica e spaziale (Roma), 26 (1): 58-70. Jan.-March 1963. In Italian, with English summary (p. 68).

A brief review is presented of several divergent opinions in the literature regarding blood changes appearing during discontinuous chronic hypoxia. Rabbits were exposed to simulated altitudes of 490, 429, and 380 mm. Hf in a decompression chamber for one week. Cytomorphological examinations were made of hemoglobin, erythrocytes, hematocrit, platelets, reticulocytes, leukocytes, mean globular volume, and mean hemoglobin content and concentration in erythrocytes. Cytochemical studies were made of peroxidases, alkaline phosphatases, polysaccharides, and leukocyte mitochondria. Only erythrocytes, hemoglobin, hematocrit, reticulocytes, alkaline phosphatases, peroxidases, and mitochondrial numbers showed any statistically significant increase in relation to the increase in altitude. Four representative tables are included. (32 references)

1206
Müller, C.
[ON PSYCHIC STIMULATION OR DAMPING IN HYPOXIA AND ITS RELATION TO PSYCHOPHARMACOLOGIC PROBLEMS] Über psychische Stimulation oder Dämpfung bei Sauerstoffmangel und ihre Beziehung zu psychopharmakologischen Problemen.—Archiv für Psychiatrie und Nervenkrankheiten (Berlin), 204 (2): 199-208. 1963.
In German.

800 clinical protocols of low-pressure chamber tests carried out by the Swiss army were analyzed with respect to changes in the psychic functions. All subjects were a highly select group of physically and mentally healthy men, 20 to 30 years old. Three distinct types of reactivity to oxygen lack could be differentiated in the pre-collapse phase in hypoxia. The most frequently observed one consisted of a damping of mental functions preceded by a short stimulated phase. Least frequently observed was a progressive release of inhibitions up to the point where unconsciousness ensued. The differences in psychic reactivity to oxygen lack are held to be based on constitutional and developmental factors in the formation of personality substrate as well as situational factors. Certain parallels are drawn between the manner of response to hypoxia and the effect of neuroleptic drugs.

1207
Murakami, U.,
Y. Kameyama, and H. Nogami
SKELETAL MALFORMATION IN THE MOUSE FETUS CAUSED BY MATERNAL HYPOXIA DURING EARLY STAGES OF PREGNANCY.— Annual Report, Research Inst. Environmental Med., Nagoya Univ. (Nagoya), 10 [for 1961]: 45-53. 1962. In English.

Female mice were subjected to hypoxia at a simulated altitude of 30,000 ft. for five hours on the 8th day of pregnancy (Group A), the 9th day (Group B), 10th day (Group C), 11th day (Group D), and 12th day of pregnancy (Group E). Cranial defects resulting from a brain hernia or exencephalia and cleft plate with hare-lip were detected in fetuses of the Groups A and B. A few cases of cleft plate occurred in Groups C and D. Malformation of the axial skeleton presented a clear head-to-tail gradient shift. The age at exposure and the location of the vertebral malformation were related. The thoracic vertebrae were most sensitive on the 10th day in the embryo. Malformation of the extremities were most noticeable in Group C and were limited to the hind limb. It is concluded that the location of the malformation of the skeletal system and the critical period for producing the malformation fluctuates depending on the agent used, the time at which it is used, and the species or strain of the experimental animals. (28 references)

1208
Murray, J. F.,
and I. M. Young
REGIONAL BLOOD FLOW AND CARDIAC OUTPUT DURING ACUTE HYPOXIA IN THE ANESTHETIZED DOG.—Amer. Jour. Physiol. 204 (6): 963-968. June 1963.

The circulatory effects of breathing low concentrations of oxygen were studied in ten anesthetized dogs. Simultaneous measurements were made of cardiac output (indicator dilution technique) and blood flow to the head, kidney, and hind limb (electromagnetic flow meters). Four experiments were performed with the addition of succinylcholine to inhibit the ventilatory response to hypoxia and maintain carbon dioxide constant. A rise in cardiac output and mean arterial pressure occurred which was significantly correlated to the decrease in arterial oxygen saturation. No threshold for these responses was found. Blood flow tended to increase during hypoxia in the regions studied but the responses were variable and only the change in renal blood flow had a significant correlation to arterial oxygen unsaturation. Systemic and regional vascular resistances during hypoxia varied both in direction and magnitude of change. The preponderant effects of hypoxia influence cardiac output more than peripheral vascular resistance. (Authors' abstract)

1209
Nagy, Z.,
and J. Skolnik
THE EFFECT OF COCARBOXYLASE ON CARDIAC OUTPUT IN ACUTE HYPOXIA.—Acta medica Academiae scientiarum hungaricae (Budapest), 19 (1): 59-66. 1963. In English.

Dogs breathing an oxygen-poor mixture (8-12% oxygen) for 45-60 minutes exhibited a considerable increase in cardiac output. Intravenous injection of cocarboxylase reduced cardiac output to a level near control. Compared with control values, there was approximately a 50% rise in cardiac output in hypoxia which was reduced by cocarboxylase by about 40%. No essential change occurred in the degree of arterial hypoxia. Only a slight difference in cardiac output was found between control and hypoxic values following injections of thiamine pyrophosphate (TPP). Oxygen consumption during hypoxia increased 21%, and cocarboxylase reduced this value by 36%. The decline in oxygen consumption caused by TPP in acute hypoxia was highly significant. Total peripheral vascular resistance decreased in hypoxia, but under the effect of cocarboxylase increased to almost the control level.

1210
Obál, F.,
and M. Vicsay
THE ROLE OF THE NERVOUS SYSTEM IN THE ADAPTATION OF OXYGEN CONSUMPTION TO HYPOXIA [Abstract].—Acta Physiologica Academiae scientiarum hungaricae (Budapest), 22 (suppl.): 18. 1963. In English.

Oxygen consumption decreased in the rat breathing a hypoxic mixture (8-10% oxygen). Upon return to breathing environmental air, the hypoxic reaction did not change, or changed only slightly in repeated experiments. Experiments including the presentation of an indifferent (optic) stimulus, showed a decrease in oxygen uptake in the second or third hypoxic period, and an increase in oxygen consumption during the third or fourth period of hypoxia. In this case the conditioned reflex elicited by the indifferent stimulus was manifest by an increase in oxygen uptake. When the stimulus was not used, the body responded to hypoxia in the same manner as before the associations. Hypoxia as a stimulus altering oxygen uptake acts similarly to drugs having a peripheral site of action. Oxygen uptake increases in response to mild hypoxia, remains unchanged when hypoxia is moderate, and decreases when it is severe. The organism adapts rapidly to repeated hypoxia combined with indifferent stimuli. (Authors' abstract, modified)

1211
Penna, M.,
L. Soma, and D. M. Aviado
ROLE OF THE CAROTID AND AORTIC BODIES IN MEDIATING THE INCREASE IN CARDIAC OUTPUT DURING ANOXEMIA. —Amer. Jour. Physiol., 203 (1): 133-136. July 1962.

In 14 anesthetized dogs the inhalation of 5% oxygen in nitrogen for 2.5 minutes caused an increase in cardiac output, measured by the dye dilution technique (16.8% ± 6.1). After surgical carotid-aortic chemoreceptor denervation, anoxemia still increased cardiac output (27.1% ± 6.7). An effect of chemoreceptor denervation was the reduction of the control level of cardiac output. In the presence of a similar reduction of cardiac output by bleeding (innervated animal) anoxemia caused a greater increase in cardiac output than in the control preparation. The increase in cardiac output was accompanied by a decrease in total peripheral systemic resistance in the denervated state as compared to an increase in the innervated state. The increase in cardiac output during anoxemia was not prevented by complete spinal anesthesia. A possible cause for the increase in the denervated animal is a combination of the increase in venous return and fall in total systemic peripheral resistance. (Authors' abstract)

1212
Petrov, I. R.
[GENERAL ADAPTATION REACTIONS OF AN ORGANISM TO THE ACTION OF HARMFUL STIMULI] Obshchie prisposobitel'nye reaktsii pri deistvii na organizm vrednykh razdrazhitelei.—Vestnik Akademii meditsinskikh nauk SSSR (Moskva), 1962 (5): 87-93. 1962. In Russian.

The author presents a general summary of adaptation reactions to various stresses, including hypoxemia, hypercapnia, and hypothermia. These reactions are of the general (Selye) adaptation syndrome type. The experimental data evidently support the concept of a fundamental role played by the hypothalamus, by the anterior lobe of the pituitary gland, and by the adrenals in the adaptation. For instance, when animals were exposed to oxygen-deficient atmospheres, their resistance increased to both oxygen deficiency and hypothermia. Stimuli causing hypoxemia evoked specific adaptation responses such as compensatory dyspnea, tachycardia, elevated arterial pressure, and increased blood flow. Induced hypoxia and hypercapnia are also of significance in the adaptation syndrome. Their usefulness in adaptation to anemia is particularly emphasized.

1213
Pevzner, L. Z.
[THE EFFECT OF HYPOXIA ON THE LAYERWISE CONTENT OF CYTOPLASMIC RNA IN NEURONS OF DIFFERENT FUNCTIONAL ZONES OF THE CEREBRAL CORTEX] Vliianie gipoksii na posloinoe soderzhanie tsitoplazmaticheskoi RNK v neironakh raznykh funktsional'nykh zon kory golovnogo mozga.—Doklady Akademii nauk SSSR (Moskva), 145 (2): 447-449. 1962. In Russian.

Experiments were conducted on cats under anesthesia. Cytospectrophotometric methods of assay were used to study the ribonucleic acid content in layers II to VI of the cerebral cortex. In general, various cortical zones showed a difference in reaction to hypoxia. In the visual area, the cytoplasmic RNA content was markedly lowered in all layers. In the motor area the RNA content was lower in the neurons of layers II and V, while in layers III and IV the loss of RNA was less obvious, with practically no loss in layer VI. The neurons of the auditory area showed an RNA loss only in layers IV and V.

1214
Riedel, H.
[DIFFERENTIAL MORPHOLOGIC REACTIONS OF THE ADRENAL CORTEX IN PREGNANT AND NON-PREGNANT RATS DURING HYPOXIA] Unterschiedliche morphologische Reaktionen an den Nebennieren schwangerer und nichtschwangerer Ratten bei Sauerstoffmangel. —Frankfurter Zeitschrift fur Pathologie (Munchen), 72 (2): 179-191. 1962. In German.

Histological and histochemical investigations revealed that the changes in the adrenal cortex of the rat during hypoxia are considerably intensified by the additional stress of pregnancy. Of importance is the finding that gravid rats reacted regularly with the formation of a second or internal transformation layer in the zona reticularis. This finding supports the views put forth by Tonutti on the special function of the zona reticularis, i.e., the formation of a second or inner transformation layer under extreme external conditions. (From the author's summary)

1215
Ross, J. M.,
H. M. Fairchild, J. Weldy, and A. C. Guyton
AUTOREGULATION OF BLOOD BY OXYGEN LACK. —Amer. Jour. Physiol., 202 (1): 21-24. Jan. 1962.

The effect of hemoglobin oxygen saturation upon blood flow through the hind leg of the dog was studied by perfusing the femoral arteries of five normal dogs with blood, the oxygen saturation of which was varied between 100% and 0%, and by perfusing the femoral arteries of nine spinal animals with blood, the oxygen saturation of which was varied between 100% and 10%. The blood saturation was controlled in the following manner: The blood was obtained from the lower lobe of the left lung as it was respired with a mixture of nitrogen and oxygen. By varying the ratio of the mixture, the blood oxygen saturation could be controlled exactly. Decreasing the oxygen saturation stepwise caused a correlated increase in blood flow through the leg. The results have shown that blood flow in the nonspinal dogs increased to an average of 3.4 times the normal value as oxygen saturation fell from 100% to 0%. In the spinal dogs blood flow increased to an average of 3.1 times normal as oxygen saturation fell from 100% to 10%. These experiments demonstrate that the local tissues can autoregulate their blood flow to help maintain an adequate supply of oxygen. (Authors' abstract)

1216
Rosse, W. F.,
and T. A. Waldmann
THE ROLE OF THE KIDNEY IN THE ERYTHROPOIETIC RESPONSE TO HYPOXIA IN PARABIOTIC RATS. — Blood, 19 (1): 75-81. Jan. 1962.

Parabiotic rats, in which one partner was either nephrectomized or ureter-ligated and exposed to 9-12% oxygen, were measured as to the uptake of Fe^{59} in the peripheral red blood cells. The Fe^{59} incorporation was less in pairs in which the nephrectomized partner was hypoxic than in pairs in which the unoperated or ureter-ligated partner was hypoxic, suggesting that the kidney is important in the stimulation of erythropoiesis under hypoxia. The Fe^{59} incorporation in pairs in which one partner was hypoxic was greater than in those pairs in which one partner was nephrectomized but neither was hypoxic, suggesting that tissues other than the kidney contribute to the erythropoietic response to hypoxia. (Authors' conclusions, modified) (25 references)

1217
Schäfer, G.,
and K. H. Weiner
THE ENCYMATICAL INCORPORATION OF IRON INTO PROTOPORPHYRIN UNDER CONDITIONS OF OXYGEN-WANT.—In: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 34-41. Oct. 1963. In English and German.

Experiments were designed to answer questions of relations between bone marrow, liver, and spleen in rabbit erythropoiesis. Experimental animals were kept in a low-pressure chamber at 378 Torr (approximately 18,044 feet altitude) for 15 to 20 days. Heme and protoporphyrin were extracted from whole-tissue homogenates and compared with similar homogenates from control animals. The conclusions reached were: (1) The heme synthesis activity of liver, spleen, and bone marrow is increased by oxygen deficiency; this leads necessarily to the result that these organs participate in the production of heme for hemoglobin formation also under normal conditions. (2) Even under conditions of oxygen want, the hemoglobin will probably be synthesized by smaller elements. (3) An adaptation of the organism to chronic oxygen want is combined with an increase of the specific enzyme protein of heme synthesis.

1218
Schäfer, G.,
and K. H. Weiner
EFFECTS OF HYPOXIA ON THE ALBUMEN METABOLISM IN MAMMIFER ORGANISMS ILLUSTRATED BY WAY OF GLUTAMIC ACID—OXALIC ACETOUS ACID—TRANSAMINASIS IN SERUM.—In: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 42-50. Oct. 1963. In English and German.

Rabbits were exposed to continuous hypoxia for 980 hours (altitude equal to 6000 m. or 64 m. Hg). After 480 hours, the serum-glutamicoxalic-transaminase (SGOT) activity of young animals was identical to that at the end of exposure, i.e. about 300% more than the original value. The hemoglobin and the number of erythrocytes increased similarly. During hypoxia, the SGOT level of adult animals decreased continuously to one-third the initial value, but immediately increased after treatment. A progressive increase in hemoglobin and erythrocytes in adult animals was also noted during hypoxia.

1219
Schäfer, G.,
and H. Weiner
ON THE INFLUENCE OF OXYGEN-WANT ON THE BIOSYNTHESIS OF HEME FORMATION.—In: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E.V., Porz-Wahn/Rhld., Bericht no. 205, p. 82-87. Oct. 1963. In English and German.

The influence of low oxygen partial pressure on heme synthesis from protoporphyrin IX and iron was measured in vitro by means of incorporated radioactive iron. Increased incorporation of Fe-59 was nearly in inverse proportion to the oxygen partial pressure. Less significant influences were noted by changing the pH of the milieu, the ion concentration, and the concentration of both enzyme substrates. Steroid hormones and B vitamins did not influence synthesis.

1220
Solti, F.,
M. Iskum, G. Mark and R. Hermann
THE EFFECT OF HYPOXIA ON CORONARY BLOOD FLOW [Abstract].—Acta physiologica Academiae scientiarum hungaricae (Budapest), 22 (Suppl.): 10. 1963. In English.

In dogs with crossed circulation and isolated perfusion of the head, the effect on coronary circulation of isolated cerebral and isolated trunk hypoxia was studied. In response to isolated cerebral hypoxia, coronary flow decreased and coronary resistance significantly increased. After the relief of hypoxia coronary dilatation with a significant diminution of coronary resistance occurred. Under isolated trunk hypoxia coronary flow was considerably increased and coronary resistance decreased. Cardiac output increased slightly in isolated cerebral hypoxia, and significantly in isolated trunk hypoxia. Blood pressure increased significantly in both cases. (Authors' abstract)

1221
Solti, F.,
I. Komaromi, G. Simonyi, M. Iskum, J. Rev, and Z. Refi
EFFECT OF HYPOXIA ON VENOUS PRESSURE IN THE BRAIN. — Acta physiologica Academiae scientiarum hungaricae (Budapest), 23 (1): 9-12. 1963. In English.

Acute hypoxia induced in persons breathing a 10% oxygen mixture first produced an increase in venous tone and then a rise in cerebral and systemic venous pressure. Venous tone returned to normal upon inhalation of more oxygen, and systemic blood pressure dropped to the original level. Dibenamine administered by intravenous infusion inhibited the hypoxic increases of both venous tone and venous pressure. Data concerning the subjects during hypoxia and following Dibenamine infusion are tabulated.

1222
Strumza, M. V.,
and L. Miro
[POLYCYTHEMIA CAUSED BY INTERMITTENT HYPOXIA] La polycythémie de l'hypoxie intermittente.—Revue de médecine aéronautique (Paris), 1 (3): 57-59. March-April 1962. In French.

Rabbits exposed for eight hours daily, five days a week, to intermittent hypoxia in a decompression chamber revealed a rapid response of the hematopoietic tissues. Polycythemia increased progressively during one to three weeks of intermittent hypoxia, depending upon the individual and the degree of hypoxia. Erythrocytes liberated were found to be microcytes. Hematocrit also increased under the effect of hypoxia. Polycythemia did not persist indefinitely although exposure to hypoxia was repeated regularly.

1223
Takács, L.,
K. Kállay, and V. Vajda
THE EFFECT OF ACUTE ARTERIAL HYPOXIA ON THE ORGAN BLOOD FLOW IN RATS. —— Acta physiologica Academiae scientiarum hungaricae (Budapest), 21 (1): 87-91. 1962. In English.

Rats anesthetized intraperitoneally with sodium pentobarbital were made hypoxic for 8-10 minutes by breathing 6-10% O_2 in nitrogen. Arterial oxygen saturation, blood pressure, and cardiac output were determined. After administration of a rubidium isotope (Rb^{86}) the animals were killed and the flow fractions of the cardiac output computed from the activity found in different organs. The blood flow of each organ for 100 grams organ weight was calculated from cardiac output, flow fraction, and organ weight. The results show that in rats during acute arterial hypoxia the cardiac output is unchanged, while blood pressure and total peripheral vascular resistance are significantly diminished. Blood flow in the organs and the organ fractions of the cardiac output remain unchanged, but their vascular resistance is lower than in the control animals.

1224
Vacca, C.
[ON THE POSSIBILITY THAT VARIOUS KINDS OF STRESS, ESPECIALLY HYPOXIA, PERMIT THE ESCAPE OF INTRACELLULAR ENZYMES BY AN INCREASE IN THE PERMEABILITY OF THE CELL MEMBRANE WITHOUT TISSUE NECROSIS] Sulla possibilità che "stress" diversi, specie l'ipossia, permettano la fluoriuscita di enzimi intracellulari per aumento della permeabilità della membrana cellulare senza necrosi tissurale.—Rivista di medicina aeronautica e spaziale (Roma), 26 (3): 443-453. July-Sept. 1963. In Italian, with English summary (p. 450-451).

Heavy exercise of 6-8 minutes duration on a bicycle ergometer resulted in an increased enzyme activity (glutamic-oxalacetic and pyruvic transaminases, aldolase, lactic and succinic dehydrogenases) in the blood of 54 subjects. The author interprets this as a result of the induced hypoxia which increases the permeability of the cell membranes and allows intracellular enzymes to enter the blood. The increase in enzyme activity lasts 2-16 hours and is possibly correlated with the disturbed acid-base balance accompanying hypoxia.

1225
Van Liere, E. J.,
and J. C. Stickney
HYPOXIA.—432 p. Chicago: University of Chicago Press, 1963.

This monograph reviews the various effects of hypoxia. It includes the following: (1) experimental methods of producing hypoxia, (2) effect of hypoxia on the blood, (3) chemical changes in the blood during hypoxia, (4) effect of hypoxia on the heart and circulation, (5) effect of hypoxia on blood pressure, (6) effect of hypoxia on lymph and on vessel permeability, (7) effect of hypoxia on respiration, (8) acclimatization to hypoxia, (9) effect of hypoxia on alimentary tract, (10) hypoxia and the secretion of urine, (11) effect of hypoxia on the endocrine glands, (12) metabolism and hypoxia, (13) hypoxia and heat regulation, (14) effect of anoxic hypoxia on water distribution in the body, (15) hypoxia and nutrition, (16) effect of hypoxia on the nervous system, and (17) resistance to hypoxia.

1226
Verzhbinskaia, N. A.
[THE TISSUE MECHANISM OF ANIMAL ADAPTATION TO LOWERED OXYGEN CONTENT IN THE ENVIRONMENT] Tkanevoi mekhanizm adaptatsii zhivotnykh k ponizhennomu soderzhaniiu kisloroda vo vneshnei srede—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1962 (3): 430-441. May-June 1962. In Russian, with English summary (p. 441).

The metabolism of adenosinetriphosphoric acid in the brain and the permeability of the blood-brain barrier were studied in vivo in 11 generations of rats bred and grown in an atmosphere containing 10.5-11% oxygen. Adaptation to hypoxia is a prolonged process spanning several generations. The first adaptation phase, which lasted through at least two generations, was characterized by an increase in metabolism of ATP and in the permeability of blood-brain barrier to P^{32}. Further adaptation was marked by an increase in oxidative phosphorylation in the brain, as evidenced by the ratio of specific radioactivity of inorganic phosphorus to that of the blood; the permeability of the blood-brain barrier to P^{32} was higher than in controls. Approximately by the 8-11th generation the oxidative phosphorylation and the permeability of the blood-brain barrier reached values comparable to controls. No histological aberrations were noted. It is concluded that a hereditary adaption to hypoxia occurred in the rats by the 11th generation.

1227
Voitkevich, V. I.
[EFFECT OF CHRONIC HYPOXIA ON OXYHEMOGLOBIN DISSOCIATION CURVES IN SUCCESSIVE GENERATIONS OF WHITE RATS] Vliianie khronicheskogo kislorodnogo golodaniia na krivye dissotsiatsii oksigemoglobina belykh krys v riadu pokolenii.—Fiziologicheskii zhurnal SSSR (Moskva), 49 (5): 615-620. May 1963. In Russian.

Rats were kept and bred in a hypoxic atmosphere containing 89.5% nitrogen and 10.5% oxygen under normal pressure for 12 hours daily while the remaining hours were spent under normal atmospheric conditions. Animals of the first hypoxic generation did not show any changes in the oxyhemoglobin dissociation curves, those of the second and third generations, however, showed changes in 25% of the individuals; in the 10th to 13th generations changes occurred in 56% of the cases. These changes consisted of shifts of the dissociation curves either to the left in the area of the upper inflection, or to the right in the area of the lower inflection, or of both shifts occurring simultaneously.

1228
Voitkevich, V. I.
[THE HEMATOPOIETIC ACTIVITY OF THE HUMAN SERUM AFTER CESSATION OF CHRONIC HYPOXIA] Gemopoeticheskaia aktivnost' syvorotki krovi liudei posle prekrashcheniia deistviia khronicheskogo gipoksicheskogo faktora.—Doklady Akademii nauk SSSR (Moskva), 148 (5): 1221-1223. 1963. In Russian.

Blood serum samples of 21 mountain climbers were studied before and after 20 days of exposure to an altitude of 2000 meters. The serum activity was determined by the following method: Pieces of leukocytic film in a culture medium and serum samples were incubated in a thermostat at 37° C. for a 6-hour period. The cultures were photographed and the leukocytic migration factor was determined in the control and experimental samples. The migration index was calculated according to formula $\pi = (S_2 - S_1)/S_1$, where π = migration index, S_1 = area of the piece of leukocytic film, S_2 = the sum of areas of the same film piece plus the migration zone. The migration index of the controls was taken to be 100%. The percentage ratio of migration means of control and test samples was taken to be a numerical expression of the hematopoietic factor. Fifteen days after altitude exposure, there was an increase in the erythrocyte count and hemoglobin content in all subjects; the average hematopoietic factor was 193%±16, while before the exposure it averaged 4.0±4.

1229
Wilcox, B. R.,
W. C. Roberts, and E. K. Carney
THE EFFECT OF REDUCED ATMOSPHERIC OXYGEN CONCENTRATION ON CLOSURE OF THE DUCTUS ARTERIOSUS IN THE DOG. — Jour. Surgical Research, 2 (5): 312-316. Sept. 1962.

In control litters, born and raised under normal circumstances, the ductus arteriosus was grossly and microscopically closed by the age of eight days. Three experimental litters were born and maintained in a special chamber providing an atmosphere of normal pressure but containing oxygen at a concentration of only 10%. Six of these 21 puppies lived 13 to 17 days and all were found to have patent ductuses on pathologic study. In dogs raised in an atmosphere of low oxygen content anatomic closure was delayed even though intimal proliferation occurred. (Authors' summary, modified)

f. Environmental Temperature

[*Body temperature under 3-e;*
Thermal radiation under 6-n]

1230
Adams, T.,
and R. Elphin Smith
EFFECT OF CHRONIC LOCAL COLD EXPOSURE ON FINGER TEMPERATURE RESPONSES. — Jour. Applied Physiol., 17 (2): 317-322. March 1962.

Caucasian subjects from a temperate climate immersed their right index fingers in a stirred ice-water bath for 20 minutes four times daily for 1 month. During subsequent test immersion, fingers exposed in this way showed an earlier initiation and a more rapid rate of spontaneous rewarming and a higher and more labile final temperature level than did either the same finger before the prolonged cold exposure or other digits not chronically cold exposed. The inference derived from these data that blood flow is elevated in chronically cold-exposed fingers was supported by digital calorimetric determinations. Since finger temperature responses were modified only in the cold-conditioned digit, the term "local cold conditioning" appears justified. Variation of the number of daily exposures made clear a progressive modification of skin temperature responses to cold. During the month of repeated cold exposures, pain associated with this type of cold exposure diminished and finally disappeared. These experimental data parallel most observations on peripheral vascular responses to natural cold exposures and may suggest a mechanism for the changes under both conditions. (Authors' abstract)

1231
Adams, T.
MECHANISMS OF COLD ACCLIMATIZATION IN THE CAT.—Jour. Applied Physiol., 18 (4): 778-780. July 1963.

Thermoregulator control in cats living at 25°C. was compared to the regulation of body temperature in the same species after continuous whole-body cold exposure to an ambient temperature of 5° C. for periods exceeding two months. Rectal and extremity temperatures and metabolic rates for the two groups were examined during acute (two hours) air exposures to 23°, 10°, and 0° C. Cold acclimatizing mechanisms in the cat involve a redistribution of body heat at 23° C., obligating increased heat flux at the expense of elevated metabolism, an improved peripheral vascular defense (increased functional tissue insulation) during moderate cold exposure (10° C.), and a greater ability to increase heat production accompanied by more labile peripheral vasomotion, during more severe cold air exposure (0° C.). Although resting at 23°C., cold-acclimatized cats had lower rectal temperatures and were able to maintain higher internal body temperatures during both levels of cold stress compared to noncold-acclimatized animals. (Author's abstract)

1232
Agarkov, F. T.
[ON THE NEW POSSIBILITIES OF INCREASING THE THERMIC BODY RESISTANCE IN THE LIGHT OF EXPERIMENTAL DATA] O novykh vozmozhnostiakh povysheniia teplovoi ustoichivosti organizma v svete eksperimental'nykh dannykh. —— Patologicheskaia fiziologiia i eksperimental'naia terapiia (Moskva), 6 (1): 70-73. Jan.-Feb. 1962. In Russian.

Increased resistance of rats to the adverse effects of high ambient temperatures may be achieved not only by way of direct adaptive training to heat, but also through preventive adaptation to hypoxia, or by prophylactic administration of dibazol (2-benzylbenzimidazole hydrochloride) in doses of 1 mg./kg. or ascorbic acid in doses of 15 mg./kg. A combination of either heat adaptation training or adaptation to hypoxia with either of the pharmacological agents was found to be more effective in raising the animal's heat tolerance. (Author's summary, modified)

1233
Andersen, K. L.
COMPARISON OF SCANDINAVIAN LAPPS, ARCTIC FISHERMEN, AND CANADIAN ARCTIC INDIANS.— In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 834-839. May-June 1963.

Metabolic and thermal responses to moderate cold exposure throughout an 8-hour night at rest and sleep, and during exercise in the cold (5°C.) were studied in Lapps, Arctic Indians, and Arctic fishermen. No evidence was found for a metabolic type of acclimatization in Lapps, Arctic Indians and Arctic fishermen. The increased basal metabolic rate observed in these cold habituated people was difficult to interpret as an effect of long-term exposure. Only meager evidence was found for a hypothermic type of acclimatization in Lapps and Arctic Indians to body cooling, and there was no evidence for acclimatization through increased body insulation in the three groups. A psychological type of acclimatization to cold was exhibited by the three groups. The measurement of blood flow through the hands immersed in cold water and hands cooled by cold air indicated a local acclimatization to cold in the three groups which affected the vasomotor control of blood flow to the hands and feet. (Author's conclusions, modified)

1234
Andik, I.,
Sz. Donhoffer, Maria Farkas, and P. Schmidt
AMBIENT TEMPERATURE AND SURVIVAL ON A PROTEIN-DEFICIENT DIET.—Brit. Jour. Nutrition, 17 (2): 257-261. 1963.

Male rats were fed ad libitum at room temperature diets containing 22, 6.2, or 4/3% protein. After three weeks on the diet containing 4.3% protein, 18 of 30 rats were transferred to an environmental temperature of 5° C. for 7-9 weeks and then returned to room temperature. Rats kept at room temperature and fed the diet containing 4.3% protein immediately ceased to gain weight and all died during, or shortly after the end of, the 6th week on the diet. Animals transferred after the 3rd week to the cold immediately began to gain weight on the same diet and all of them survived while in the cold. Re-transfer to room temperature was followed by immediate cessation of body-weight gain, and in a few weeks death ensued. The fact that food intake, and with it protein intake, approximately doubled in the cold, explains the observation. Low-protein diets are not characterized adequately by their protein:calorie ratio without the consideration of total calorie intake. (Authors' abstract)

1235
Antonis, A.,
I. Bersohn and D. L. Easty
SERUM LIPID CHANGES IN YOUNG MEN IN ANTARCTICA [Abstract].—Jour. of Physiol. (London), 167 (1): 26P-27P. June 1963.

Serum lipid levels were studied in 24 members of the British Antarctic Survey base at Halley Bay. The Antarctic year can be divided into three periods: February-April, with outside temperatures ranging from -12° to -21° C., 24 hours of daylight, strenuous activity, and average daily intake of 3800 kcal.; April-September, with temperatures ranging from -23° to -35° C., polar night, minimal activity, and an intake of 3360 kcal.; October-January, with temperatures ranging from -6° to -14° C., 24 hours of daylight, increased activity, and an intake of 3660 kcal. Average serum lipid levels for the whole year were: total lipids 655.6±122.0 mg./100 cc.; phospholipids 221.4±20.7 mg./100 cc.; triglycerides 120.8±75.8 mg./100 cc. No seasonal trends were evident. There were marked subject differences in the level of serum triglycerides. Serum total cholesterol (198.8±29.3 mg./100 cc.) and β-cholesterol (165.0±33.4 mg./100 cc.) were higher in the first half of the year than in the second half. During the winter, when physical activity was at a minimum, the α-cholesterol level was depressed, and the β-cholesterol when expressed as a percentage of the total cholesterol was raised. During sledging journeys there was a high fat intake, a high level of energy expenditure, and some weight loss. Fasting samples taken on return to base showed the elevation of α-cholesterol and a depression of β-cholesterol levels. (From authors' abstract)

1236
Barsoum, A. H.
SOME OBSERVATIONS ON BLOOD IN RELATION TO COLD ACCLIMATIZATION IN THE ANTARCTIC. —— Military Med., 127 (9): 719-722. Sept. 1962.

Forty men isolated for 14 months on the Filchner ice-shelf in the Antarctic (summer high +28° F., winter average -50° F.) showed maximal changes in the white count, mainly lymphocytic, following chronic exposure, with little change on acute exposure. The erythrocyte count rose only moderately in 50% of the men after chronic exposure, but 70% reacted sharply to acute exposure, the remaining 30% showing a hemolytic reaction instead. The sudden rise in erythrocyte count, with concomitant rise in hemoglobin and hematocrit, is explained on the basis of the hemoconcentration which is postulated to occur on cold exposure due to a shift of blood fluid elements to the extracellular spaces.

The eosinophil count showed elevation (50-100%) in all cases following chronic cold exposure and this remained throughout the entire period. However, on further acute exposure no further change was noted.

1237
Belding, H. S.,
and T. F. Hatch
RELATION OF SKIN TEMPERATURE TO ACCLIMATION AND TOLERANCE TO HEAT.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 881-883. May- June 1963.

Changes in the skin which occur during heat acclimatization include: (a) increased conductance (metabolic heat is more readily transferred from the body core to the skin surface); (b) increased sweating, which is the more conspicuous feature of acclimation to wet heat than to dry; (c) fall in threshold skin temperature for onset of sweating (equivalent rate of sweating is achieved at a lower skin temperature after acclimation); (d) earlier onset of sweating, presumably a consequence of onset at lower skin temperature; and (e) better distribution of sweat over the skin. A greater wetted area is advantageous in wet heat under conditions when evaporation is the limiting factor. Improvement in tolerance which accompanies acclimation to both dry and wet heat emphasizes the fundamental importance of the downward shift in threshold skin temperature for sweating.

1238
Benetato, G.,
V. Stănescu, V. Mănescu, C.Vlad, M. Gardev, and S. Stîrcu
[RESEARCH CONCERNING CEREBRAL PROTEIN CATABOLISM OF THE RAT DURING EFFORT AT A HIGH TEMPERATURE] Cercetări asupra catabolismului proteic în creierul de sobolan în timpul efortului la temperatură înaltă.—Studii şi cercetari de fiziologie (Bucureşti), 7 (4): 589-599. 1962. In Rumanian, with French summary (p. 597-598).

Cerebral and blood serum pH, ammonia, amino acids, and nitrogen were studied in rats exposed to hot and moderate temperatures during effort. Cerebral pH during effort at moderate temperature tended toward acidity (from 6.96 to 6.58) and at high temperature, even at rest, towards alkalinity (from 7.08 to 7.10). Ammonia increased moderately during effort at moderate temperature, becoming higher in the heat at rest, and increasing more during effort if the animal was maintained for 2-3 hours in the heat. This increase was more pronounced in the brain than in the plasma. Of the amino acids, glutamic acid decreased without effort at high temperature, declining more during effort at moderate temperature, and decreasing markedly during effort at high temperature (from 8.1 to 1.53 micromoles). Non-protein nitrogen increased simultaneously with ammonia at rest at high temperature (from 1.025 to 1.101 (dry tissue)) and during effort from 1.22 to 1.29; soluble proteins decreased in moderate temperature at rest and during effort. This confirms the opinion of Vrba and Weil-Malherbe that the source of ammonia in nerve tissue is represented by the process of proteolysis.

1239
Blatteis, C. M.
EFFECTS OF SOME PHARMACOLOGIC AGENTS ON COLD TOLERANCE OF DOGS. — Amer. Jour. Physiol., 203 (5): 829-833. Nov. 1962.

Eight unanesthetized, shaved dogs were studied in 32 experiments for their thermal and metabolic responses to 90 minutes of exposure to 6° C. during peripheral vasoconstriction (metaraminol bitartrate, 0.3 mg./kg.), peripheral vasodilatation (trimethaphan camphorsulfonate, 10 mg./kg.), and increased heat production [2,3-dinitrophenol (DNP), 2.5 mg./kg.]. In the cold, the temperatures of the metaraminol-vasoconstricted dogs fell more rapidly and lower than temperatures of controls, whereas the temperatures of the trimethaphan-vasodilated dogs decreased more slowly but also fell lower than those of controls; DNP retarded the temperature fall of these hypermetabolic dogs in the cold, but did not affect its degree. The vasodilating drug delayed the onset of shivering, whereas DNP hastened it; shivering in the vasoconstricted dogs began at a time not significantly different from that of controls. (From the author's abstract)

1240
Blockley, W. V.
HEAT STORAGE RATE AS A DETERMINANT OF TOLERANCE TIME AND DURATION OF UNIMPAIRED PERFORMANCE ABOVE 150 F.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 887-890. May-June 1963.

The slope of the straight line relating mean body temperature and exposure time in noncompensable heat-stress situations yields an index of body heat storage rate which is a reliable predictor of tolerance time. The storage rate so determined shows good agreement with that resulting from solution of the heat balance equation; thus a biothermal analysis to establish the magnitude of all heat gain and loss terms for the body permits the estimation of the tolerable duration of exposure to any severe heating condition. The duration of unimpaired performance capability for a complex psychomotor task was found to be approximately 75% of the tolerance time. The beginning of performance deterioration was found to coincide with the onset of distress symptoms which are associated with the tolerance end-point. Large individual differences in the extent of terminal deterioration appeared to be related to the skill level in the task, as indicated by control sessions at comfort temperatures. (Author's summary)

1241
Bogusławski, W.
SURFACE TENSION AND ACTIVE THERMOREGULATION IN MAN: PRELIMINARY REPORT. — Biuletyn instytutu medycyny morskiej v Gdansku (Gdansk), 13 (1-2): 69-75. 1962. In English.

In vitro experiments led to the conclusion that oil covering of the skin may constitute a good protection against overheating for individuals working at high temperature. The use of cosmetics, particularly of fat-neutralizing soap which may paralyze the sebaceous glands, is not recommended. The degree of fat depletion of the skin may be one factor determining an individual's tolerance of high ambient temperatures.

1242
Boulouard, R.
EFFECTS OF COLD AND STARVATION ON ADRENOCORTICAL ACTIVITY OF RATS.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 750-753; discussion, p. 753-754. May-June 1963.

In the rat exposed to moderate cold (4.5°C.) for 48 hours, a significant increase was found in the levels of plasma cortico-sterone and Porter-Silber chromogens, as well as adrenal hypertrophy, indicating cortical hyperactivity. Starvation brought about a significant increase in the level of plasma corticosterone and Porter-Silber chromogens and a correlated adrenal hypertrophy. Cold exposure, in addition to starvation, provoked an increased adrenocortical response reflected by high values of plasma glucocorticoids and by the weight of the gland. A comparison of the responses of nourished rats exposed to cold and rats subjected to 48 hours of starvation revealed that fasting alone determined an adrenocortical response stronger than the action of cold in the nourished animal. Cold accompanied by starvation brought about a maximal adrenocortical response by provoking a mobilization of body reserves. (36 references)

1243
Brauer, R. W.,
R. W. Balam, H. E. Bond, H. W. Carroll, J. W. Grisham, and R. L. Pessotti
REVERSIBLE AND IRREVERSIBLE CHANGES IN LIVER AT TEMPERATURES APPROACHING CRITICAL UPPER LEVEL.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 724-728. May-June 1963.

An exploratory study was made of the effects of various levels of heat exposure (37.5° C.-42.3° C.) on isolated perfused rat liver. Three phenomena were recognized: (1) reversible biochemical changes in blood glucose and lactic acid levels and early changes in oxygen consumption and bile flow rate; (2) development of irreversible changes such as decreased bile flow rate and tissue glycogen content; and (3) regurgitation of $CrPO_4$ colloid and sudden sequence of changes in oxygen uptake, pH, and lactic acid levels. Changes such as reduced oxygen consumption at 37.5° C. in previously heat-exposed liver, the dissolution of endoplasmic reticulum, and cumulative effects of successive heat exposure periods on bile secretion provide some basis for speculation about the mechanisms by which heat injury is produced. Three possible mechanisms may account for the observed events in the heat-exposed liver: disruption of metabolic patterns and depletion of key metabolites; direct effects of cellular enzyme systems; and structural changes possibly leading to changes in effective cell compartmentation.

1244
Brebner, D. F.,
D. M. Kerslake, and D. G. Soper
SOME EFFECTS OF EXPOSURE TO AN ENVIRONMENT OF SATURATED AIR AT MOUTH TEMPERATURE. —— Jour. Physiol. (London), 162 (2): 244-258. July 1962.

Subjects were weighed continuously while exposed to an environment of air saturated with water vapor at 39° C. After the first 10 minutes the mouth temperature increased steadily with time. The rate of weight loss at first increased with time and rising mouth temperature, later reached a maximum, and then decreased. The most constant parameter examined was the maximum increase in rate of weight loss for a rise of temperature of 0.4° C. ("G"). The value of G for an exposure in the afternoon could be predicted from the observed value the same morning with 95% confidence limits of about ±30%. The value of G and the rate of weight loss at 38.5° C. (near the maximum) increased several times during daily exposures terminated at mouth temperatures of 38.4-38.6° C. The possible use of this type of exposure as an index of the sensitivity of the sweating mechanism is discussed. (Authors' summary, modified)

1245
Brebner, D. F.,
and D. McK. Kerslake
THE EFFECT OF SOAKING THE SKIN IN WATER ON THE ACCLIMATIZATION PRODUCED BY A SUBSEQUENT HEAT EXPOSURE [Abstract].— Jour. Physiol. (London), 166 (1): 13P-14P. April 1963.

Inhibition of sweating was produced by immersing four subjects up to the neck in a bath of stirred water between 34.5° and 35.0° C. for four hours. The acclimatizing stimulus was a similar immersion for 40 minutes at 39.0° C., a severe heat exposure which raised the mouth temperature to 39.2° C. The performance of the sweating mechanism was assessed by measuring the rate of weight loss in a saturated environment at mouth temperature. Such assessments were made one day before and after two consecutive daily heat exposures, both of which were either preceded by four-hour immersions (pre-soak) or followed by them (post-soak). Two subjects were given pre-soak exposures the first week and post-soak the second. The order was reversed for the other two subjects. The sweat loss during the hot bath was approximately halved by the pre-soak. All subjects showed a marked increase in sweating in the assessment trial following the post-soak exposures. In contrast, the pre-soak exposures did not increase the sweating response to the assessment environment. The results support the view that the increase in sweating seen in acclimatization to heat is dependent on the secretory activity of the sweat glands. (From the authors' abstract)

1246
Brouha, L.
HEAT AND THE OLDER WORKER. —— Jour. Amer. Geriatrics Soc., 10 (1): 35-39. Jan. 1962.

For light to moderate work performed in a comfortable environment (72° F.), most older workers are as efficient as younger ones. As the environment becomes warmer (90° F.), body heat dissipation becomes progressively more difficult and the heart rate increases, more so in the older worker than in the younger. Higher heart rates during work and less complete recovery during rest periods lead to accumulated strain as the shift progresses.

Fatigue appears sooner in the older worker and results, in many instances, in lower productivity at greater physiologic cost.

1247
Brown, G. Malcolm,
R. E. Semple, C. S. Lennox, G. S. Bird, and C. W. Baugh
RESPONSE TO COLD OF ESKIMOS OF THE EASTERN CANADIAN ARCTIC.—Jour. Applied Physiol., 18 (5): 970-974. Sept. 1963.

Skin, muscle, and rectal temperatures and oxygen consumption of Eskimos and Caucasians were compared during an acute cold exposure involving immersion of one hand and forearm in a 5° C. water bath. The Eskimos consumed less oxygen, maintained their rectal temperatures at a higher level, and gave up less heat from the muscles of the limbs. Though the Eskimos had significantly more adipose tissue, average skin temperatures were the same in the two groups. The pattern of temperatures noted now and the previously observed higher blood flow in the hand and forearm of Eskimos point to increased cooling of arterial blood by returning venous blood in the extremities with resultant preservation of heat in the body core. (Authors' abstract)

1248
Budd, G. M.
ACCLIMATIZATION TO COLD IN ANTARCTICA AS SHOWN BY RECTAL TEMPERATURE RESPONSE TO A STANDARD COLD STRESS. — Nature (London), 193 (4818): 886. March 3, 1962.

Four members of the 1958-1960 Australian National Antarctic Research Expedition were exposed to air of 50° F. for 95 minutes while lying naked on a nylon-mesh mattress for a total of 40 exposures. This was done before, during and after a year in the Antarctic. In the Antarctic the rectal temperature rose significantly after exposure. After return to milder weather this response decreased to a lower level than that found before the year in the Antarctic. These results show that acclimatization in man enhances his ability to maintain the deep body temperature, and loss of acclimatization lessens this ability.

1249
Burch, G. E.,
and N. P. DePasquale
HOT CLIMATES, MAN AND HIS HEART.—xiv+196 p. Springfield, Illinois: Charles C. Thomas, 1962.

This is a review of the physiological and pathological effects of hot climates, with particular reference to the cardiovascular system of man. It comprises the following chapters: Climatology, man and medicine; The role of the skin in thermal regulation; Methods of measuring sensible and insensible water loss from the surface of the body; Cutaneous water and electrolyte barrier; The electrolyte content of sweat and the kinetics of electrolyte excretion by the sweat glands (includes acclimatization, heat cramps, heat exhaustion); Peripheral circulation; Water and Heat loss from the lungs: methods and theoretic considerations; The effect of thermal stress on the cardiovascular system of man: theoretic considerations of the estimation of cardiac work; The effect of thermal stress on the normal and diseased cardiovascular systems of man; The effect of thermal stress on renal function; General physiological responses to thermal stimulation; and Clinical syndromes due to excessive exposure to a hot and humid climate. A subject index is included and each chapter contains a bibliography.

1250
Buskirk, E. R.,
R. H. Thompson, and G. D. Whedon
METABOLIC RESPONSE TO COLD AIR IN MEN AND WOMEN IN RELATION TO TOTAL BODY FAT CONTENT. — Jour. Applied Physiol., 18 (3): 603-612. May 1963.

Eight healthy young men (ages 19-35), four older men (ages 38-42), and three obese subjects (two women and one man, ages 38-42) were individually exposed on one or more occasions to 10°C. (50°F.) air in the Metabolic Chamber for periods of 2-4 hours. A minimal amount of clothing was worn. The metabolic response to cold determined from oxygen volume and carbon dioxide volume was significantly and inversely related to per cent body fat according to the regression equation: $\text{kcal.}/(\text{m.}^2 \cdot \text{hour}) = 65.2 - 0.520\ (\%\ \text{fat}) \pm 0.115$. Total body insulation after 2 hours of exposure was significantly and directly related to per cent body fat and inversely related to the metabolic response. Despite these significant relationships, wide individual differences were observed in the metabolic response to cold between pairs of subjects of like age, previous history of cold exposure, and body fatness. (From the authors' abstract)

1251
Chevillard, L.,
R. Portet, and M. Cadot
GROWTH RATE OF RATS BORN AND REARED AT 5 AND 30 C.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 699-702; discussion, p. 702-703. May-June 1963.

In rats born and reared at 5° C., growth rate was slower and the adult body weight less than that found in animals born and reared at 30° C. It appears that the growth rate in animals born in winter at 5° or 30° C. was delayed in comparison to that in those born during other seasons. Tail length is a function of the temperature of rearing. In females born at 20° or 30° C. this organ played a more important part in heat dissipation than in the male. Acclimatization to a temperature other than that of birth caused, in growing rats, a change in tail length which was a true adaptation to the new environment. The average number of animals per pregnancy and the sexual distribution was not altered by gestation at 5°, 20°, or 30° C. The percentage of fertilization was less at 5° C. and was also less in animals born and kept at 5° and 30° C. as compared to those merely adapted to these temperatures. (Authors' conclusions)

1252
Clark, R. E.,
and Clarke E. Jones
MANUAL PERFORMANCE DURING COLD EXPOSURE AS A FUNCTION OF PRACTICE LEVEL

AND THE THERMAL CONDITIONS OF TRAINING. — Jour. Applied Psychol., 46 (4): 276-280. Aug. 1962.

Three groups of 10 subjects each were given varied thermal experience (warm or cold hands) during three weeks of training on a standard manual task. The results were as follows: (a) one day of cold-hand training significantly reduced the size of a manual decrement usually associated with cold exposure, but continued cold experience did not; (b) skill level on the task per se did not interact with the cold-induced performance decrements; and (c) the thermal conditions associated with performance on the task appeared to become part of the stimulus complex eliciting correct manual responses when these thermal conditions were maintained for a large number of trials, i.e., the subjects learned not merely to perform on the task, but to perform with warm, or cold, hands specifically. (Authors' summary)

1253
Collins, K. J.
ENDOCRINE CONTROL OF SALT AND WATER IN HOT CONDITIONS.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 716-720; discussion, p. 720. May-June 1963.

Changes in salt and water balance induced by exposure to hot environments involve changes in the excretion of antidiuretic hormone and salt-active steroids of the adrenal cortex. The extent of the involvement depends on the state of unbalance induced by salt and water depletion. The mechanism controlling the secretion of these hormones is, however, imperfectly understood. There is good evidence to suggest that salt-active adrenocortical hormones directly affect the sweat glands as well as the kidneys. (Author's summary)

1254
Connolly, J. M.
THE PROTECTIVE EFFECTS OF PRETREATMENT WITH ADRENOCORTICOTROPHIC HORMONE IN TRAUMATIC SHOCK.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775601). Technical Documentary Report no. SAM-TDR-63-10, May 1963. iii+3 p.

Adrenocorticotropic hormone (ACTH) was given to rats prior to subjecting them to a measured, severe, surgical trauma. Pretreated animals were able to maintain their systolic blood pressure at normal levels while untreated animals showed marked hypotension at the conclusion of the trauma. Animals which were stressed by being subjected to a cold environment (3° to 5°C.) for one week before trauma and pretreated with ACTH showed no difference in mean systolic blood pressure from untreated stressed controls. Pretreatment with ACTH has a definite vasopressor effect in previously eucorticoid animals. (Author's abstract)

1255
Consolazio, C. F.,
L. O. Matoush, R. A. Nelson, L. R. Hackler, and E. E. Preston
RELATIONSHIP BETWEEN CALCIUM IN SWEAT, CALCIUM BALANCE, AND CALCIUM REQUIREMENTS. — Jour. Nutrition, 78 (1): 78-88. Sept. 1962.

Seven men consuming 441 mg. of calcium a day for a period of 48 days excreted 8.1, 11.6, and 20.2 mg./hour of calcium when living at 70°, 85°, and 100° F. This accounted for 21.8, 25.1, and 33.2% of the total calcium excreted. It was observed that (a) the calcium excreted in sweat, in men working at a moderate rate in extreme heat (100° F.), was still fairly high after acclimatization, averaging 17 mg./hour after the first four days; and (b) that the daily total calcium in sweat increased as the sweat rate increased. It appears that the calcium requirements may be increased under these conditions. It was shown that even after acclimatization the urinary calcium did not decrease in compensation for the losses of calcium in sweat. Changes in the urinary excretion of calcium in adjusting to different levels of dietary calcium and the various other metabolic factors, may require months to achieve. (Authors' summary, modified)

1256
Consolazio, C. F.,
L. O. Matoush, R. A. Nelson, J. B. Torres, and G. J. Isaac
ENVIRONMENTAL TEMPERATURE AND ENERGY EXPENDITURES. — Jour. Applied Physiol., 18 (1): 65-68. Jan. 1963.

Metabolic rates (oxygen consumption) were compared on seven young men performing three levels of physical activity at three environmental temperatures of 70°, 85°, and 100° F. This study indicates that as the environmental temperature increases there is also an increase in metabolic rate of men performing a fixed activity. It is shown that there was a significantly higher metabolic rate for men working at 100° F. than at 85 and 70° F. These increases averaged 11.4% for the rest period, 13.3% for the moderate activity, and 11.7% for the heavier activity. Body temperatures also were significantly higher at 100° F. than at 85° and 70° F. environments ($P < .005$). They averaged 99.6° F. for the 100° F. temperature, and 99.1° F. for both the 85° and 70° F. temperatures. The findings in this study indicate that the metabolic rate of a fixed physical activity is increased in the heat and that this increase is not due to acclimatization or training. (Authors' abstract)

1257
Croton, L. M.
MEASUREMENT OF THE EFFECT OF THE THERMAL ENVIRONMENT ON MAN. — Jour. Sci. Technol. (Edinburgh), 8 (2): 64-73. April-June 1962.

The physiological effects of an indoor environment within the comfort range, or one which imposes a mild thermal stress, may be assessed by means of the Effective (or Corrected Effective) Temperature scale. The effect of work on the thermal load on man may be usefully integrated into the nomogram of Effective Temperature to give a closer approximation of the total physiological effect of the environment. The effects of an indoor environment which causes severe thermal strain on the subject may be assessed by the integrated index of the Predicted Four-hour Sweat Rate (P4SR). This index is valid only for its defined purpose and may not be extrapolated either upward or downward without appreciable error. The P4SR Index shows the physiological effects of air movement, clothing, and work load. The outdoor environment is a variable complex and no valid over-all index has been developed for it as yet. The Wet-bulb/Globe-temperature Index measures the physical environment which may be related to the effects of a moderate to severe thermal strain. Computation of the P4SR Index is made in the appendix. (Author's conclusions, modified)

1258
Davies, A. G.
CHANGES IN PALMAR SWEATING OF MEN IN THE ANTARCTIC [Abstract].—Jour. Physiol. (London), 165 (1): 50P. Jan. 1963.

Plastic finger prints of the left middle finger pad were prepared on ten consecutive mornings by three members of the British Antarctic Survey party at Marguerite Bay in the autumn, winter, and summer. The prints were made before rising with the subjects comfortably warm. An analysis of variance showed that the mean palmar sweat index in winter was significantly less than the means for either autumn or summer. Prints were also prepared by four subjects on alternate mornings during a 6-week dog sledge journey. Two subjects showed reductions of the palmar sweat index throughout the journey. For these subjects the difference between control mean and journey mean was significant. The third subject showed a reduction of the index during the first half of the journey, and the fourth subject during the second half. For these subjects the difference between control and journey means was not significant. The men spent less time out of doors in winter, so the cold to which they were subjected was probably no greater in winter than in other seasons. It is suggested that the reduction of palmar sweat index was associated with psychic stresses occurring in men living at a base hut for a long period during winter. During the sledge journey all subjects were exposed to similar physical and environmental conditions. The individual pattern of the change in palmar sweating could possibly be due to different emotional responses to the conditions of the journey. (Author's abstract, modified)

1259
Davis, T. R. A.
NONSHIVERING THERMOGENESIS.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 777-782. May-June 1963.

On the basis of the review of the literature on nonshivering thermogenesis presented, it is concluded that man can acclimatize to cold and does so by a decrease in shivering and by an enhancement of existing nonshivering thermogenic mechanisms or by its induction as an altogether new mechanism. Frequent observations of an increased oxygen consumption prior to evidence of shivering supports the belief that nonshivering thermogenesis is an already existing mechanism in unacclimatized man, as in animals, and that it is increased by acclimatization. Animal data suggest that fat mobilization is necessary for its proper functioning and that noncontracting muscle is an important site of nonshivering heat production. Although shivering is decreased or abolished by acclimatization, increasing the cold stress re-elicits the response and supplements nonshivering thermogenesis. The total heat-producing capability of the acclimatized homeotherm is greatly enhanced, resulting in a greater ability to maintain homeothermy in extreme cold, as demonstrated in animals. The data in man indicate that the acclimatized response consists of a decreased cold response associated with a raising of the threshold requirement for its elicitation. (From the author's discussion)

1260
Dedichen, J.,
P. Laland, and S. G. Laland
THE EFFECT OF MATERIAL PREPARED FROM OX BLOOD ON COLD STRESS IN MICE.—Acta pathologica et microbiologica scandinavica (Copenhagen), 58 (2): 219-224. 1963. In English.

Subcutaneous administration of high-molecular material prepared from ox blood to mice 24 hours prior to cold stress significantly reduced the mortality of the animals over a certain dosage range. Higher doses were without an effect. It is suggested that the material is related to a hypothetical resistance factor. The effect of the material is probably displayed on a cellular level. (Authors' summary, modified)

1261
DesMarais, A.,
and I. I. U. Akpabio
EFFECTS OF COLD EXPOSURE AND ASCORBATE ADMINISTRATION OF ASCORBIC ACID BIOSYNTHESIS AND THYROID SECRETION RATE OF THE WISTAR RAT.—Revue canadienne de biologie (Montreal), 22 (1): 27-31. March 1963. In English.

Thyroid secretion rates and in vitro liver biosynthesis of ascorbic acid were measured in rats treated with ascorbic acid and exposed to cold (1° C.), and at room temperature (20-26° C.). Ascorbic acid administration (1) decreased thyroid secretion rate during the first week of cold exposure; (2) had no effect on the decrease in ascorbic acid biosynthesis observed after one week in the cold; and (3) prevented the increase in biosynthesis observed after six weeks of cold exposure. (Authors' abstract, modified)

1262
DeTurck, J. E.,
and L. J. Berry
BODY TEMPERATURE AND CARBOHYDRATE VALUES IN NORMAL AND ENDOTOXIN POISONED MICE EXPOSED TO LOWERED ENVIRONMENTAL TEMPERATURES.—Bryn Mawr Coll., Pa. (Contract AF 41(657)-340); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8241-32). Technical Documentary Report no. AAL-TDR-62-4, Aug. 1962. iii+25 p.

A comparison is made between the rectal and the body surface temperatures of fed mice housed in individual compartments without bedding while exposed continuously to environmental temperatures of 5° C., 15° C., and 25° C. Surface temperatures of the mice are related to the ambient temperature at which they are held. Rectal temperatures are known to undergo cyclic variations and, except for the first 24 hours at 5° C., are within normal limits throughout a week of exposure. Fasted animals at 5° C. cannot maintain a core temperature beyond about 6 to 12 hours and all die within 24 hours. Injection of an LD$_{50}$ dose of endotoxin failed to depress liver and muscle glycogen and total body carbohydrate after three hours at 15° C., but after an exposure of five hours liver glycogen alone remained unchanged. At 5° C., carbohydrate reserves were depleted in liver, muscle and total body after three hours in fasted mice but not in fed mice. After five hours, muscle glycogen alone was lowered. Endotoxin poisoned mice lost carbohydrates after three hours and five hours at both 5° C. and 15° C. (Authors' abstract) (55 references)

1263
Durrer, J. L.,
and J. P. Hannon
SEASONAL VARIATIONS IN CALORIC INTAKE OF DOGS LIVING IN AN ARCTIC ENVIRONMENT. — Amer. Jour. Physiol., 202 (2): 375-378. Feb. 1962.

The seasonal variations in the average daily caloric intake and body weight of five Husky dogs and five beagle dogs were measured over 12- and 8-month periods, respectively, during which the average monthly temperature ranged from +17° C. to -22° C. The caloric intake of the Huskies rose from a midsummer low of 49 kcal./kg./day to a November high of 87 kcal./kg./day. Mid- and late winter values averaged about 79 kcal./kg./day. During late winter there was no relationship between the day-to-day temperature and caloric intake. In the beagles, acute and later chronic exposure to cold in March caused a marked increase (80-131 kcal./kg./day) in caloric intake. They, like the Huskies, tended toward minimum values (85 kcal./kg./day) during the summer. With the onset of winter the beagles increased their intake to a high of 144 kcal./kg./day in November. Overall, these data showed that the relative magnitude of the seasonal changes were quite similar in both groups of dogs and suggested that seasonal changes in insulation are supplementary to seasonal changes in caloric intake. (Authors' abstract)

1264
Eagan, C. J.
FACTORS AFFECTING TOLERANCE TO COOLING OF THE FINGERS [Abstract]. — Physiologist, 5 (3): 133. Aug. 1962.

The responses to finger cooling in 0.0° C. water for 10 minutes and in air at -20° to -25° C. (with moderate air movement) for 30 minutes, or until fingers cooled to -5° C., were compared in 3 groups of subjects. The groups consisted of: six control subjects who were on the laboratory staff; four Eskimos who normally lived in northern Alaska but who had lived in a temperate climate on an ordinary mixed diet for nine months previous to the tests; six mountaineers who had undergone rigors of daily cold exposure of the extremities for 45 days in the course of an ascent of Mt. McKinley. Subjects with higher basal metabolic rates tended to maintain higher average finger temperatures during both water and air cooling. Physical fitness scores were in the order: mountaineers > Eskimos>> controls. There was no correlation between level of physical fitness and resistance to finger cooling. The most marked differences between the groups were in the air cooling tests. The fingers of all the control subjects cooled to -5° C. before the end of the test (average 22 minutes). All of the Eskimos withstood 30 minutes of cooling. Three of the mountaineers who had not suffered cold injury lasted 30 minutes with their fingers at lower (average 15° C.), and hence more economical, temperatures than those of the Eskimos (average 22° C.). (From the author's abstract)

1265
EAGAN, C. J.
LOCAL VASCULAR ADAPTATIONS TO COLD IN MAN.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 947-951; discussion, p. 951-952. May-June 1963.

White airmen divided into control and starved groups and Alaskan Indians immersed their finger in ice water for ten minutes. Temperatures of the compared fingers did not differ during immersion but in pain sensations. The Indian group maintained the highest finger temperature and suffered negligible pain. There was no evidence for local vascular cold adaptation but conclusive evidence was found for specific habituation among airmen. The finger temperature of the habituated group was greater than that of the controls. The slightly lesser pain of the starvation group may be accounted for by their cold experiences during the starvation regimen. General habituation to the experimental conditions resulted in less vasoconstrictor outflow to fingers immersed in ice water. Levels of metabolic rate and finger temperature were directly related. In another experiment there were no differences in basal metabolic rate or in early morning body temperatures between mountaineers, Eskimos, and Caucasian controls. Vascular responses of the fingers compared for the groups during 10 minutes of ice-water immersion revealed that the average minute-by-minute temperatures were similar for controls and mountaineers. Eskimos maintained higher finger temperatures in ice water, suggesting that some sort of genetic cold adaptation may exist. Pain sensations were almost negligible for Eskimos in both water- and air-cooling tests. Some evidence was found for habituation in mountaineers during water-cooling tests.

1266
Edholm, O. G.,
J. M. Adam, and R. H. Fox
THE EFFECTS OF WORK IN COOL AND HOT CONDITIONS ON PULSE RATE AND BODY TEMPERATURE. — Ergonomics (London), 5 (4): 545-556. Oct. 1962.

Subjects performed work daily for four hours in cool conditions for two weeks, and then on one day in a hot environment. Thereafter, both groups continued the daily work, one in hot conditions, the other in cold, for a period of 12 days. The energy expenditure did not change throughout the experiment. In the cool environment, after approximately one week, post-work pulse rate and body temperature remained relatively constant, and so were the pulse rate and body temperature increments during work. On first exposure to heat, post-work body temperature and pulse rate were greater than in the cool conditions. All parameters decreased with each successive day of work in the heat, but post-work pulse rate and body temperature did not reach the levels attained in cool conditions. Post-work pulse rate and body temperature are linearly related, and a correction can be made to the pulse rate by subtracting 27 beats/1° C. for the rise of body temperature above 37° C. The value obtained is approximately equal to the post-work pulse rate observed in cool conditions. Assessing energy expenditure from post-work pulse rate or body temperature or their increments during work in the heat may be misleading, as the results depend upon the degree of acclimatization. If a correction is made for the level of body temperature, an approximate measure of energy expenditure can be made irrespective of the state of acclimatization. (From the authors' summary)

1267
Edholm, O. G.,
R. H. Fox, J. M. Adam, and R. Goldsmith
COMPARISON OF ARTIFICIAL AND NATURAL ACCLIMATIZATION.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 709-715. May-June 1963.

Fifty-four men were divided into three groups of 18 men, matched on the basis of their responses to a standardized heat test. One group was sent to Aden to become naturally acclimatized to heat, the control group went to a cool climate in Scotland, and the third group was artificially acclimatized to heat by daily exposure for four hours to a controlled hot humid climate in a climatic chamber. All groups reassembled in the laboratory and were retested in the climatic chamber. The Aden group and the group treated in the chambers were approximately equal in their responses and were considered fully acclimatized to heat. All groups were flown to Aden, where they carried out very strenous military exercise in severe heat for 12 days. After this the subjects returned to the United Kingdom, where a third test in the climatic chambers showed that all three groups were now highly acclimatized to heat. In the field, the body temperature increase of the artificially acclimatized group was significantly less than that of the control group and slightly smaller than the increases in the naturally acclimatized group. In spite of this physiological advantage of the artificially acclimatized group, the military performance was worse and the incidence of casualties higher than in the naturally acclimatized group. (From the authors' summary)

1268
Edholm, O. G.
HEAT ACCLIMATIZATION STUDIED IN THE LABORATORY AND THE FIELD: A MULTIDISCIPLINARY APPROACH [Abstract].—Ergonomics (London), 6 (3): 304-305. July 1963.

Three groups of 18 men each, matched on the basis of response to heat in a climatic chamber, were (a) naturally acclimatized in Aden, (b) artificially acclimatized to heat in a climatic chamber, or (c) controls. The control group consistently had higher body temperatures than the other two groups during periods of work. The artificially acclimatized group had the lowest body temperature on nearly all occasions but the difference between the two acclimatized groups was small. Differences between water intake, daily weight changes, and urine volume between the three groups was small. Psychological tests of intelligence, vigilance, and short-term memory did not show any clear difference between the three groups when performance in the heat was compared with performance in a comfortable environment. The control and artificially acclimatized groups had approximately the same number of clinical casualties, although the control group had more casualties during the first three days. Naturally acclimatized subjects had a lower incidence of casualties. (Author's abstract modified)

1269
Elsner, R. W.
COMPARISON OF AUSTRALIAN ABORIGINES, ALACALUF INDIANS, AND ANDEAN INDIANS.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 840-842. May-June 1963.

A comparison of responses of various peoples and Caucasian controls exposed to eight hours of sleeping in moderate cold revealed distinct general responses related to deep body temperatures, body insulation as indicated by skin temperatures, and to heat production and distribution. The Australian aborigines responded to cold by maintaining metabolism at about the same or a slightly decreased rate and by general deep body and superficial cooling. The Chilean Alacalufs, on the other hand, maintained their metabolism about 50% above that of the Australian aborigines, ending the night at the level of the Caucasians. Their average skin temperatures were similar to those of Australian aborigines, but their foot temperature decreased at a slower rate. The high altitude Peruvian Quechua Indians maintained relatively high skin and foot temperatures in spite of low rectal temperatures. Included are representative figures of metabolic responses, rectal temperatures, foot temperature, and average skin temperatures during the night's cold exposure, and skin fold thickness at various sites in Eskimo and Caucasian.

1270
Elsner, R. W.,
and A. Bolstad
THERMAL AND METABOLIC RESPONSES TO COLD OF PERUVIAN INDIANS NATIVE TO HIGH ALTITUDE.—Inst. of Andean Biology, Lima, Peru (Contract AF 41(657)-249); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-45). Technical Documentary Report no. AAL-TDR-62-64, June 1963. iii+25 p.

Thermal and metabolic responses of eight male Peruvian Indians native to an altitude of 4000 to 4500 meters were studied during night-long exposures to moderate outdoor cold (2° to 5°C.). In addition, four of the subjects were studied during cold exposure while chewing coca leaves, alleged by them to have protective effects during cold exposure. The metabolic rate of the eight subjects was elevated during cold exposure but did not differ significantly from averaged values for 17 Caucasian control subjects studied under similar conditions in previous experiments. Differences between the thermal responses of the Indian subjects and of the same Caucasian controls were noted in the generally higher hand and foot temperatures, and the correspondingly lower rectal temperatures, of the high-altitude dwellers. The Indian subjects using coca did not display any measurable differences in their responses with or without the drug but, by observation and by their own report, they did sleep longer and more comfortably when using coca. (Authors' abstract)

1271
Everett, N. B.,
and R. W. Caffrey
RATE OF RED CELL FORMATION IN RATS AT 24° C. AND AT 5° C.—Univ. of Washington, Seattle (Contract AF 41(657-104); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-02). Technical Documentary Report no. AAL-TDR-62-20, July 1962. iii+9 p.

Radioautography of peripheral blood subsequent to Fe^{59} administration was employed to determine the rate of erythrocyte formation in male Sprague-Dawley rats maintained at 24° C. and after exposure to 5° C. for 4, 5, and 6 weeks. The rate at which newly-formed labeled cells appeared in the blood was approximately 3% per day of the total circulating erythrocyte population for both control and experimental animals. This rate was the same for animals of two body weight ranges, 150 to 200 grams and 300 to 400 grams. Assuming that the rate of new red cell formation is equal to the rate of red cell destruction, the circulating life span of the rat erythrocytes is estimated to be approximately 33 days. (Authors' abstract)

1272
Evonuk, E.,
and J. P. Hannon
CARDIOVASCULAR FUNCTION AND NOREPINEPHRINE-THERMOGENESIS IN COLD-ACCLIMATIZED RATS.—Amer. Jour. Physiol., 204 (5): 888-894. May 1963.

Norepinephrine (NE) caused a greater increase in the cardiac output, heart rate, stroke volume, and right atrial pressure in the cold-acclimatized (C-A) (3° C.) animals than it did in warm-acclimatized (W-A) (26°C.) animals. During the early metabolic response to NE (i.e., up to 25% increase in oxygen consumption) there was a marked increase in the arterial pressure of both W-A and C-A rats, with the latter showing the greater maximum response. Beyond the 25% level of increased metabolism the arterial pressure and concomitantly the systemic resistance of the C-A animals declined sharply to the preinfusion levels where they remained throughout the course of infusion. In contrast to this, the arterial pressure and systemic resistance of the W-A animals remained high. Norepinephrine-calorigenesis in the C-A rat is supported by a greater capacity to increase the cardiac output and an ability to preferentially reduce the systemic resistance to actively metabolizing areas (i.e., the viscera). (Authors' abstract, modified)

1273
Evonuk, E.,
and J. P. Hannon
CARDIOVASCULAR AND PULMONARY EFFECTS OF NORADRENALINE IN THE COLD-ACCLIMATIZED RAT.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 911-916. May-June 1963.

The increased sensitivity of the cold-acclimatized rat to the calorigenic effects of noradrenaline, as studied at normal room temperature under anesthesia, was supported by a general improvement in the functional reserve capacity of the cardiovascular and pulmonary systems. This improvement was largely attributable to an improved capacity for increasing cardiac output and preferentially reducing systemic resistance while noradrenaline was being infused and thus increasing the blood flow to the actively metabolizing tissues (e.g., the viscera). This reduction of systemic resistance could result from one or more of the following factors: (1) an increased rate at which infused noradrenaline was removed from the circulation; (2) an increased pressor response threshold to noradrenaline; and (3) an activation of other mechanisms (possibly neurohumoral or dialator metabolites) which are antagonistic to the pressor action of noradrenaline. Included are representative figures of the effects of noradrenaline on cardiac output, heart rate, stroke volume, arterial pressure, right atrial pressure, systemic resistance, tissue blood flow, pulmonary minute volume, tidal volume, and respiratory rate of warm- and cold-acclimatized rats.

1274
Evonuk, E.,
and J. P. Hannon
PULMONARY EFFECTS OF COLD ACCLIMATIZATION AND NOREPINEPHRINE CALORIGENESIS.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-01). Technical Documentary Report no. AAL-TDR-62-57, June 1963. iii+10 p.

The effects of cold acclimatization on pulmonary function during norepinephrine calorigenesis were studied, Norepinephrine resulted in a marked increase (85%) in the pulmonary minute volume in both the warm- and cold-acclimatized rats. This increase in the warm-acclimatized rats was accomplished entirely by increasing the respiratory rate, whereas in the cold-acclimatized rats the increase in pulmonary minute volume was achieved for the most part by increasing the tidal volume with a slight increase in respiratory rate. Cold acclimatization was associated with a greater "efficiency of oxygen extraction" before, during and after the infusion of norepinephrine. (Authors' abstract)

1275
Findlay, J. D.
ACCLIMATIZATION TO HEAT IN SHEEP AND CATTLE.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 688-690. May-June 1963.

There is little knowledge on the acclimatization processes in cattle and practically none whatever on those of sheep, but acclimatization in both species involves adjustments in the metabolic heat production of the animal with consequent lowering of productivity. It also involves changes in the pattern of respiratory activity and in adrenothyroid function. Variation in the nature of the coat cover is probably the most significant adaptive change that occurs in cattle exposed to heat stress. Experiments on acclimatization in cattle and sheep comparable to those performed in man have not as yet been done.

1276
Fox, R. H.,
and H. T. Wyatt
COLD-INDUCED VASODILATATION IN VARIOUS AREAS OF THE BODY SURFACE OF MAN. —Jour. Physiol. (London), 162 (2): 289-297. July 1962.

The distribution of the cold-induced vasodilatation phenomenon over the body surface of man has been tested at thirty-four sites on three male subjects. A combined cold applicator and heat-flow indicator was designed for the purpose. The cooled area was 3 cm. in diameter and cooling was continued for half an hour. Cold-induced vasodilatation responses were elicited from all the areas previously shown to exhibit the phenomenon. In addition, positive responses were elicited in one or more of the subjects from all other parts of the head and neck tested, the olecranon and patella regions, the perianal region, over the buttocks, and on the chest close to the nipples. Initial vasoconstriction was particularly short-lived in most of the sites tested on the head and neck, and the high heat flows from these regions during cold-induced vasodilatation indicate very high rates of blood flow during cold stimulation. The distribution of easily elicited and marked cold-induced vasodilator responses found in this study accords well with the classical theory that the phenomenon is found in areas of the body likely to be exposed to severe local cooling in cold climates. (Authors' summary)

1277
Fox, R. H.,
R. Goldsmith, D. J. Kidd, and H. E. Lewis
ACCLIMATIZATION TO HEAT IN MAN BY CONTROLLED ELEVATION OF BODY TEMPERATURE.—Jour. Physiol. (London), 166 (3): 530-547. May 1963.

Body temperature was first rapidly elevated in a very hot and humid air stream and then maintained at target level for the duration of treatment by sweating the subject dressed in a vapor-barrier suit which could be variably ventilated in a room at 38° C. The effects of elevating the oral temperature to 37.3°, 37.9° or 38.5° C. and maintaining it for 1/2, 1, or 2 hours daily for 12 days were studied in 18 men. Before and after heat-treatment the subjects were given a two-hour conventional heat exposure or uniformity test with alternating rigidly controlled periods of work and rest in a hot climate (40° C.). The sweat rates in the first half hour were markedly enhanced by each increment in oral temperature. In the early exposures sweat rates for the two higher temperature groups declined rapidly, reaching the low level maintained throughout by the subjects at 37.3° C. in 1 1/2-2 hours. By the end of the heat-treatment period both the 1/2-hour and 2-hour sweat rates of the higher temperature groups had approximately doubled. Pulse rates during temperature elevation were either unchanged or higher at the end of 12 days. Pre-exposure oral temperatures fell during the heat-treatment period. At the uniformity test following heat treatment the subjects showed the classical signs of heat acclimatization. The increases in sweat loss closely reflected the intensity and duration of body-temperature elevation imposed during the heat-treatment period. The primary adaptive response to heat is a higher sweat rate for a given rise in body temperature, and the total secretory activity of the sweat glands during the period of heat exposure very largely determines the degree of adaptation induced. (Authors' summary, modified)

1278
Fox, R. H.,
R. Goldsmith, D. J. Kidd, and H. E. Lewis
BLOOD FLOW AND OTHER THERMOREGULATORY CHANGES WITH ACCLIMATIZATION TO HEAT.—Jour. Physiol. (London), 166 (3): 548-562. May 1963.

The vasomotor and sudomotor responses of 20 subjects to a standardized heat-stress test were studied before and after acclimatization to heat. Blood flow in the vasoconstrictor release areas (hand and ear) rose steadily from the time of the onset of heating, while in the forearm and chest there was a pronounced increase in the rate of rise of blood flow associated with the onset of sweating. Blood flow of all areas studied increased relative to body temperature after acclimatization; in the forearm the increase was about one third while in the hand it was only about one tenth. Pre-heat body temperatures were, on average, 0.19° C. lower after acclimatization. Following acclimatization the onset of sweating occurred when the body temperature was 0.18° C. lower and the water-bath temperature 0.36° C. lower. Both before and after acclimatization sweating began when body temperature was still below the pre-heating levels. Sweat rate was higher relative to body temperature after acclimatization, and resting pulse rate and pulse rate relative to blood flow were lower. The lower resting body temperature and the earlier onset of sweating are attributed to an increased sensitivity of the thermoregulatory system. (Authors' summary, modified)

1279
Fregly, M. J.,
K. M. Cook, and A. O. Otis
EFFECT OF HYPOTHYROIDISM ON TOLERANCE OF RATS TO HEAT.—Amer. Jour. Physiol., 204 (6): 1039-1044. June 1963.

Hypothyroid (propylthiouracil-treated) rats show slower rates of rise of both colonic and skin temperatures than do control rats when both groups are restrained and exposed to air at 40° C. The increased tolerance to heat does not appear to be associated with increased heat conductance through skin but rather with lower heat production (oxygen consumption). Metabolic rate of hypothyroid rats decreases slightly during heat exposure while that of controls increases. When both groups are compared at the same colonic temperatures during heating, the metabolic rate of hypothyroid rats is significantly less than that of controls. The lower metabolic rate may be a reflection of the lower level of spontaneous muscular activity observed in these animals during heating. The greater tolerance of hypothyroid rats to heat thus appears to be associated with an ability to resist an increase in heat production as colonic temperature rises. (Authors' abstract)

1280
Furman, K. I.,
and G. Beer
DYNAMIC CHANGES IN SWEAT ELECTROLYTE COMPOSITION INDUCED BY HEAT STRESS AS AN INDICATION OF ACCLIMATIZATION AND ALDOSTERONE ACTIVITY.—Clinical Science (London), 24 (1): 7-12. Feb. 1963.

Three heat-acclimatized and three relatively less heat-acclimatized persons were subjected to single two-hour heat stress exposures (45-47° C.). Serial forearm sweat samples were collected during successive half-hour periods of the test to determine the sodium and potassium content and the sodium/potassium ratio. Dynamic changes in the concentrations of these electrolytes and a progressive rise in their ratio were greater in the less acclimatized as compared to the relatively more acclimatized persons who tended to maintain a steadier state of sweat electrolyte secretion. A two-week heat stress acclimatization procedure resulted in a progressive decrease in dynamic electrolyte changes during exposure to heat stress. This decrease was effectively overcome by the administration of the aldosterone antagonist "Aldactone". The dynamic pattern of changes in the sweat sodium and potassium concentrations and sodium/potassium ratio is an indication of acclimatization to heat stress. There is indirect evidence to indicate that the dynamic rise in the sodium/potassium ratio during exposure to heat stress is affected by aldosterone activity. (From the authors' summary)

1281
Gilgen, A.,
R. P. Maickel, O. Nikodijevic, and B. B. Brodie
ESSENTIAL ROLE OF CATECHOLAMINES IN THE MOBILIZATION OF FREE FATTY ACIDS AND GLUCOSE AFTER EXPOSURE TO COLD.—Life Sciences, no. 12: 709-715. Dec. 1962.

On exposure of normal rats to cold (4° C.), the body temperature remained almost normal for 20 hours or more. To maintain a constant body temperature, the animals mobilized and oxidized additional free fatty acid (FFA) and glucose. After pretreatment with chlorpromazine, the body temperature rapidly declined, and within 4 hours the animals died at a body temperature of 13° C. Rats exposed to cold after treatment with the ganglionic blocking agent, chlorisondamine (Ecolid) showed a decline in temperature, and they died within 5 hours at 13° C. Plasma levels of FFA and glucose did not increase. However, on pretreatment of the animals with epinephrine in oil, the animals survived. Chemically sympathectomized, adrenal demedullated rats exposed to cold showed a precipitous fall in body temperature, the animals dying in about 4 hours at 13° C. Plasma levels of FFA and glucose did not increase. If these animals were pretreated with epinephrine in oil and then exposed to cold they survived, plasma glucose and FFA increased, and the decline in body temperature was largely prevented. Cold-exposed adrenal demedullated rats showed an increase in plasma FFA levels but not of glucose. Body temperature of these animals fell slowly but steadily, reached 13° C. in about 11 hours when the animals died. It is concluded that an intact sympathetic nervous system is essential for increasing the output of FFA and glucose on cold exposure and may constitute a link between physiological and biochemical processes. Mobilization of energy substrates appears to be regulated by enzyme systems activated by the nervous system.

1282
Grayson, J.,
and T. Kinnear
TEMPERATURE OF HUMAN LIVER.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 775; discussion, p. 776. May-June 1963.

In West African adults the mean liver temperatures were slightly higher than rectal temperature when measured in the recumbent position under hot humid conditions (29.8°C., 83% humidity). After cooling for 40 minutes at 25.8°C., 57% humidity, the liver temperature fell, relative to rectal temperature, by a mean value of 0.44°C. The experiments were repeated with the subjects covered completely with blankets, apart from head and face. Skin temperature under the blankets showed no changes during the cooling period. The 40-minute cooling period had a variable effect on rectal temperature but produced consistent cooling of the liver relative to the rectum. Liver blood flow showed no change. It is concluded that at the end of the cooling period, the liver is cooler than the blood supplying it, possibly brought about by the activity of a respiratory route of heat loss.

1283
Guseva, L. A.
[THE ADENOSINE TRIPHOSPHORIC ACID AND CREATINE PHOSPHATE CONTENTS IN BRAIN AND MUSCLES OF ANIMALS ADAPTED OR NON-ADAPTED TO COLD] Soderzhanie adenozintrifosfornoi kisloty i kreatinfosfata v mozgu i myshtsakh u adaptirovannykh i neadaptirovannykh k kholodu zhivotnykh.—Voprosy meditsinskoi khimii (Moskva), 9 (2): 180-184. March-April 1963. In Russian, with English summary (p. 184).

Two groups of mice were subjected to an environmental temperature of 5° C.; one group was cooled only once, the other cooled for 11 days with 2-hour interruptions for feeding. After this preliminary treatment, the animals were exposed to cooling for 1, 2, or 3 hours. They were then killed by immersion in liquid nitrogen. The brain tissues of the cold-adapted group showed no significant changes in adenosine triphosphoric acid (ATP) and creatine phosphate (CP) concentrations; however, the concentrations in muscle tissue were lower than those of controls. In the nonadapted animals, an increase in ATP and CP concentrations was noted in both brain and muscle after cooling.

1284
Gwozdz, B.
[THE EFFECT OF THE THERMAL STRESS ON THE LEVEL OF 17-HYDROXY-CORTICOSTEROIDS IN THE BLOOD SERUM OF MAN] Poziom 17-hydroksykortykosterydow (17-OHST) w krwi czlowieka poddanego stressowi cieplnemu.—Endokrynologia polska (Warszawa), 13 (3): 275-286. 1962. In Polish, with English summary (p. 285-6).

121 healthy coal mine rescue workers were subjected to a temperature of 50°C. (dry heat) and 60% relative humidity for one and two hours. The level of 17-hydroxycorticosteroids (OHST) in the blood serum increased (by 84% and 62% respectively) whereas the number of acidophil leukocytes decreased (52% on the average). Seven individuals showed a decrease of 17-OHST concentration after the thermal test. No correlation was noted between the rise of the 17-OHST level and the resistance of the healthy organism to microclimate action. It seems that the mechanisms of adaptation to heat in man do not depend exclusively on the hormones secreted by the adrenal cortex. The loss of consciousness noted in some of the individuals tested indicates that the decisive factor in the tolerance of the organism to heat stress lies in the adaptation ability on the part of the circulatory system. (Author's summary, modified) (29 references)

1285
Hale, H. B.,
E. W. Williams, and J. P. Ellis
CATECHOLAMINE EXCRETION IN HEAT-ACCLIMATIZED MEN.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775801). Technical Documentary Report no. SAM-TDR-63-20, March 1963. iii + 5 p.

Sympathoadrenal activity was appraised in 10 healthy young men over a 10-week period, beginning in summer and ending in autumn. Two overnight urine samples per subject per week were analyzed for norepinephrine, epinephrine, creatinine, and urea. Evidence of high sympathoadrenal activity was obtained in summer, with reversal in autumn. The different catecholamines were shown to relate either to weekly mean maximum temperature, to weekly mean solar radiation, or to both climatic factors. Catecholamine excretion also tended to vary inversely with urea excretion, which may be interpreted as indicating interaction between catecholamines and thyroid hormone, the latter possibly modifying metabolic actions of the former. The results also may be interpreted as indicating that catecholamines contribute to the regulation of blood distribution, a function of major importance in heat acclimatization. (Authors' abstract)

1286
Hale, H. B.,
and R. B. Mefferd
THERMAL SPECTRUM ANALYSIS OF THYROID-DEPENDENT PHASES OF NITROGEN AND MINERAL METABOLISM.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 766-771. May-June 1963.

Urinary determinations and temperature dependency were plotted for rats living for months at 2°, 24°, or 35° C. The results presented for acutely cold-exposed rats were manifestations of adrenal-thyroid interplay, whereas those for cold-acclimated rats were basically thyroid-dominated. Heat caused thyroid depression, but in acute heat there was thyroid-adrenal interplay, and in chronic heat thyroid and adrenocortical influences both adjusted to the need, which was low. Weight loss in acute cold was less than in chronic cold suggesting that corticosteroids acted antagonistically to thyroid hormones, in this one respect. Antagonism was also indicated in acute heat and was evident in phosphate and histidine excretion. Adrenal-thyroid interplay appeared to take different forms, depending on the metabolic level. Urine volume showed augmentation, greater displacement appearing in acute heat and cold than in chronic heat or cold, respectively. The same pattern appeared for magnesium. Increases were shown by sodium, but not potassium. Corticosteroids apparently increased urea and calcium responses in cold, but blocked the effects of heat on these two variables. Temperature dependency was evident at all times, but fasting reduced it in certain cases and increased it in others. Of special interest are the results for urine/water ratio, phosphate, and calcium. Fasting induced diuresis of some degree at all temperatures. Temperature dependency in phosphate and calcium excretion was as strong during fasting as in the fed state.

1287
Hall, J. F.
EFFECT OF VAPOR PRESSURE ON PHYSIOLOGIC STRAIN AND BODY HEAT STORAGE.—Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722204). Technical Documentary Report no. AMRL-TDR-62-147, Dec. 1962. iii+8 p.

Also published in: Jour. Applied Physiol., 18 (4): 808-811. July 1963.

Physiologic strain in terms of body heat storage and other physiologic responses were measured and compared in two series of heat stress experiments performed on human subjects exposed to different ambient vapor pressures. One group of 75 experiments conducted on 5 healthy nonacclimatized male subjects exposed five times each to 38°, 54°, and 71° C. at 10 mm. Hg vapor pressure was compared with a series of 81 experiments performed on 10 similar subjects exposed 1-6 times each to 38°, 41°, and 54° C. at 20 mm. Hg vapor pressure. Exposure times were 180, 120, and 60 minutes, respectively. Subjects were sitting and wore 1.0-clo insulation. The data show relations between body heat storage and (a) the modified Craig index of physiologic strain; (b) over-all sweat rate; (c) evaporative rate; (d) sweat-evaporative ratio; (e) mean skin and rectal temperatures; and (f) change of heart rate at the respective vapor pressure levels. Statistically significant correlation between sweat-evaporative ratio and over-all sweat rate with body heat storage is shown. Use of the over-all sweat response as a physiologic strain index is suggested. (Author's abstract)

1288
Hammel, H. T.
EFFECT OF RACE ON RESPONSE TO COLD.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 795-800. May-June 1963.

A comparison was made of several ethnic groups in terms of the average metabolic response of each group as a function of the mean body temperature. The following groups were studied: Australian Aborigines, Kalahari Bushmen, Alacaluf Indians, Arctic Indians, Andean Indians, Eskimos, whites in Australia, Eastern and Western Arctic whites, Korean diving and nondiving women, Korean men, and American white men and women. Discussion is also included on physiological studies of whole body exposure to cold in primitive man; the effects of diet, physical fitness, and acclimatization to other stresses on response to cold; and survival value of physiological adaptations to cold.

1289
Hammel, H. T.
SUMMARY OF COMPARATIVE THERMAL PATTERNS IN MAN.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 846-847. May-June 1963.

Original man was presumably a hairless or nearly hairless being, due to factors either unrelated to energy exchange between body and environment. If hairlessness had some thermal advantage it was to facilitate evaporative heat loss from perspiring skin surface during prolonged periods of activity under the sun. With the advent of fire, protective garments, and house-buildings man moved into cold environments. Most descendents of these populations still residing in cold or frigid zones display a high resting or basal metabolic rate. The major adaptation is technological. When exposed to moderate cold at night, their shell does not become highly insulative and they commence to shiver, although not as much as Europeans. Indigenous Americans living in cool but not frigid zones have retained or redeveloped a high level of thermal technology and have not mitigated entirely the chronic aspects of cold stress of their environment by suitable garments and housing. They retain a degree of cold habituation which implies greater shell cooling and insulation along with elevated resting metabolic rate which is characterized as metabolic acclimatization.

1290
Hannon, J. P.,
and A. Rosenthal
EFFECTS OF COLD ACCLIMATIZATION ON LIVER DI- AND TRIPHOSPHOPYRIDINE NUCLEOTIDE. — Amer. Jour. Physiol., 204 (3): 515-516. March 1963.
Also issued as: Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-02). Technical Documentary Report no. AAL-TDR-62-40, Jan. 1963. iii+7 p.

The levels of oxidized and reduced di- and triphosphopyridine nucleotide were measured in liver tissue from rats that had been exposed to cold (about 4°C.) for one month. These animals exhibited about 65% more reduced and total triphosphopyridine nucleotide than control animals maintained at an ambient temperature of about 25° C. The significance of these alterations to the efficiency of oxidative phosphorylation is discussed. (Authors' abstract)

1291
Hannon, J. P.
CURRENT STATUS OF CARBOHYDRATE METABOLISM IN THE COLD-ACCLIMATIZED MAMMAL.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 856-861. May-June 1963.

Two days of cold exposure in rats induced a marked increase in lactic dehydrogenase and glucose-6-phosphatase activity of liver tissue, and a marked increase in glutamic oxalacetic and glutamic pyruvic transaminases of liver and muscle. In the liver the combined effects of an increased glucose-6-phosphatase and transaminase activity implies an improved capability or potential gluconeogenesis. Cold acclimation (one month at 4°C.) was associated with an increase in the activity of enzymes mediating catabolism of dietary glucose over the Embden-Meyerhof pathway. These enzymes include glucokinase, which catalyzes initial phosphorylation of blood sugar, and the sequence of enzymes between 3-phosphoglycerate and pyruvate. The latter includes phosphoglyceromutase, enolase, and pyruvic kinase. These changes indicate an increased liver capacity for formation of pyruvate from dietary glucose. Prolonged cold exposure was also associated with an elevated glucose-6-phosphatase activity, an increase in the capacity of the liver to oxidize a wide variety of substrates ranging around the tricarboxylic acid cycle from citrate to malate, and oxidation of several substrates feeding into the cycle either directly (glutamate) or indirectly (palmitate and β-hydroxybutyrate). Lactate was the only metabolic intermediate not oxidized at a higher than normal rate. Malic and succinic dehydrogenase in liver and muscle from control and cold acclimatized rats exhibited activity increases, as did glutamic pyruvic- and glutamic oxalacetic transaminases.

1292
Harrison, G. A.
TEMPERATURE ADAPTATION AS EVIDENCED BY GROWTH IN MICE.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 691-697; discussion, p. 697-698. May-June 1963.

Mice from 3 to 12 weeks old were reared at either 21° C. dry-bulb, 16° C. wet-bulb or at 32° C. dry-bulb, 29° C. wet bulb temperatures using a split-litter experimental design. The comparative growth rate clearly indicated that the hot environment was more favorable than the temperate one for young animals.

1293
Hart, J. S.,
H. B. Sabean, J. A. Hildes, F. Depocas, H. T. Hammel, K. L. Andersen, L. Irving, and G. Foy
THERMAL AND METABOLIC RESPONSES OF COASTAL ESKIMOS DURING A COLD NIGHT. — Jour. Applied Physiol., 17 (6): 953-960. Nov. 1962.

Metabolic and thermal studies were conducted at night at Pangnirtung, Northwest Territories, on a group of ten Eskimo hunters from Cumberland Sound, Baffin Island, and on three white controls, to compare their reactions to cold (5°±1° C.) with that of other racial groups. Cumberland Sound Eskimos maintained a resting metabolism that was elevated, according to DuBois standards, during sleep on warm nights. This elevation was not found in hospitalized men who had been living for an average of 6 months in Edmonton, Alberta. During exposure to moderate cold, the Cumberland Sound

Eskimos and white controls had an elevated metabolism, shivering, and a disturbed sleep. Peripheral temperatures were maintained at a higher level in Eskimos than in whites. Because of the absence of marked physiological differences between Eskimos and whites, it is concluded that the principal adaptation of these Eskimos to their climate is technological. (Authors' abstract)

1294
Hart, J. S.
SURFACE COOLING VERSUS METABOLIC RESPONSE TO COLD.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 940-942; discussion, p. 942-943. May-June 1963.

Very large species differences exist in the level of surface cooling at which thermogenesis is stimulated, but within the species the correlation between surface cooling and thermogenesis may be quite precise. In the caribou, seal, and man the correlation between surface cooling and metabolic response to cold appears to hold for wide variations in temperature, wind, and moisture. However, the relation may be shifted by acclimatization or by different racial or ethnic backgrounds. Since skin temperature appears to be an integrator of the metabolic response to cold and it varies widely in different species there are accordingly large species differences in the sensitivity of the peripheral sensing mechanism. This applies particularly for afferent reflex discharge of cutaneous receptors subserving sensation and cold induced thermogenesis. (From the author's summary)

1295
Hendler, E.
TEMPERATURE EFFECTS ON OPERATOR PERFORMANCE.—In: Unusual environments and human behavior, p. 321-352. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

The basic physical concepts of temperature are reviewed and the effects on the performance of operators exposed to temperature extremes is emphasized. The complicated nature of the reaction is reflected throughout the organism, from biochemical to cardiovascular changes. The effects of temperature extremes vary with different skills (e.g., decrease of finger dexterity in cold) that involve physical work, but tasks involving perception and reasoning or judgment are also affected. The operator's skill may determine how his performance will be affected by temperature, and performance improvement in adverse ambient temperature conditions by the use of incentives is indicated. In case of equipment failure, severe temperature stress could result unless acclimatization by preflight daily heat exposures took place. (60 references)

1296
Héroux, O.,
and D. Wright
ADJUSTMENTS TO CONSTANT LOW TEMPERATURES IN WHITE RATS LIVING IN GROUPS.—Canad. Jour. Biochemistry and Physiol (Ottawa), 41 (3): 587-595. March 1963.

White rats, in groups of ten, were exposed for three months in the laboratory to constant temperatures of 19°C. or -10°C. Grouping the animals did not alter the pattern of metabolic adaptation usually observed in individually cold-acclimated rats and recently observed in group-caged white rats exposed outdoors during the winter. This pattern of adaptation was characterized by an increased capacity for heat production, as shown by a longer survival time at -35°C., a reduction of shivering, an increased sensitivity to noradrenaline, an increased ear vascularization, a reduction in protein and fat deposition, and an enlargement of heart, liver, and kidneys. Group-caging at constant low temperature (a) prevented the development of cold injuries and the enlargement of pituitary, thyroid, and adrenals, which are usually observed in individually cold-exposed rats indoors; and (b) resulted in an increased resting metabolism, normal adrenal cortex activity, and no increase in pelt insulation in contrast to that previously found in white rats grouped outdoors during the winter. These different adjustments to cold in white rats exposed to different sets of environmental conditions are compared with similar adjustments found in wild Norway rats. (From the authors' abstract)

1297
Héroux, O.
PATTERNS OF MORPHOLOGICAL, PHYSIOLOGICAL, AND ENDOCRINOLOGICAL ADJUSTMENTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS OF COLD. In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 789-792; discussion, p. 792-794. May-June 1963.

The use of wild Norway rats versus white laboratory rats, caged in a group or singly, under different environmental conditions (climatic chambers maintained at low temperature versus the cold climate of an Ottawa winter) revealed that chronic cold exposure in the laboratory or outdoors brings about essentially the same fundamental mechanism for metabolic adaptation. This mechanism is characterized by an increased capability to produce sustained heat through nonshivering thermogenesis. Of all the adjustments studied, only a greater sensitivity to norepinephrine appeared necessarily linked with nonshivering thermogenesis. These adjustments took place whether pelt insulation was increased or not. Hyperplasia of pituitary, thyroid, thymus, and adrenals, as well as cold injuries, were observed only in white rats exposed individually to cold. Protein depots, as revealed by total body growth and muscle mass, and fat depots were always reduced and visceral organs enlarged in white rats exposed to cold indoors or outdoors, individually or in groups. Nonshivering thermogenesis was not necessarily found to be linked with greater thyroid activity, and adrenal cortex adjustments varied with environmental conditions.

1298
Hertig, B. A.,
H. S. Belding, K. K. Kraning, D. L. Batterton,
C. R. Smith, and F. Sargent
ARTIFICIAL ACCLIMATIZATION OF WOMEN TO HEAT. — Jour. Applied Physiol., 18 (2): 383-386. March 1963.

Acclimatization to heat, repeatedly demonstrated in male subjects, has not been reported in females. This paper presents quantitative evidence for heat acclimatization in women. Nine women participated in daily 2-hour walks in the heat for 2-3 weeks. By the usual criteria (reduced pulse rate, reduced rectal temperature rise, lower skin temperature, ability to complete the assigned task, and subjective comfort) all subjects became acclimatized to heat. (Authors' abstract)

1299
Hertig, B. A.,
and F. Sargent
ACCLIMATIZATION OF WOMEN DURING WORK IN HOT ENVIRONMENTS.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 810-813. May-June 1963.

Acclimatization to three hot environments (21° C., 45° C., 50° C.) by nine women after two hours of treadmill walking appeared to follow the same general time course as in men. Women manifested the same physiological adjustments associated with acclimatization in males: reduced pulse rate; reduction in body core and skin temperature rise; onset of sweating at a lower skin temperature; and lessened discomfort. Females reached limits of endurance in hot environments easily tolerated by males. Two factors appeared to put the female at a disadvantage in the heat: (a) lower thermal gradient for removal of metabolic heat, and (b) less reserve capacity to move blood to the skin. (Authors' conclusions, modified)

1300
Hildes, J. A.
COMPARISON OF COASTAL ESKIMOS AND KALAHARI BUSHMEN.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 843-845. May-June 1963.

Eskimos produced more heat per hour during warm nights, about 30% more than Bushmen, and 13% more than whites. In the cold, all three groups increased their metabolic heat production. Whites showed the greatest increase by 38%, Eskimos by approximately 17%, and the Bushman who has a low rate to begin with, increased by about 20%. The Bushman was much colder than the Eskimo at the end of a cold night. His rectal temperature was down a degree compared to a mean drop of half a degree in the Eskimos and no change in whites. The Bushman's skin was also much cooler than that of the Eskimo. At any skin temperature the metabolic rate of the Bushman was less than that of the Eskimo. Sleeping during a cold night the Bushman's heat-producing mechanism was not stimulated even though rectal and skin temperatures were low: the afferent limb of the temperature regulated mechanism was adjusted to function at a lower than usual temperature. In this respect the Bushmen differ from the whites and the Eskimo. Included are figures for average metabolic responses, relationship between mean skin temperature and metabolic rate, body size and composition in Eskimos and Bushmen.

1301
Honda, N.,
W. V. Judy, and L. D. Carlson
INFLUENCE OF PRIOR COLD EXPOSURE ON PERIPHERAL VASCULAR REACTION ON RABBIT EAR INDUCED BY ABRUPT COLD EXPOSURE.—Univ. of Kentucky, Lexington (Contract AF 41(657)-335); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-39). Technical Documentary Report no. AAL-TDR-61-50, May 1962. iii+9 p.

The influence of prior cold exposure on vasoconstriction induced by abrupt cold exposure was studied in the rabbit ear. Dutch-breed rabbits were individually caged outdoors (maximum temperature, 21° C.; minimum, -7° C.; average, 5.9° C.) and a control group was kept at 27°C. over a five-month period. Three groups of New Zealand rabbits were divided to be exposed to 27° C., 5° C., and 5° C. day and 27° C. night temperatures. Rectal, ear, and body surface temperatures, heat loss from the ear, and blood flow in the ear were recorded at 27° C., 23° C., and 5° C. In general, at 23° and 27° C. there was no difference between the groups of rabbits. After one hour exposure to 5° C., outdoor and 5° C. groups had a low blood flow to the ear and had no decline in rectal temperature. Other groups, however, had a decrease in rectal temperature and higher ear blood flow. After 12 to 18 hours exposure to 5° C., rectal temperature returned to original values in the 27° C. animals; blood flow to the ear decreased slightly. Ear blood flow in outdoor and 5° C. rabbits increased during this period. (Authors' abstract)

1302
Hong, S. K.
COMPARISON OF DIVING AND NONDIVING WOMEN OF KOREA.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 831-833. May-June 1963

The oral temperature of woman divers was lowered by 2-4° C. during the course of a dive. The magnitude of reduction was greatest in the winter and was least in the summer. The basal metabolic rate underwent a characteristic seasonal variation in which it was elevated greatly during the winter but was at the normal level in the summer. In general, the basal metabolic rates were inversely related to the sea water temperature. Shivering threshold was considerably elevated in the divers as compared to nondiving females in both the summer and the winter. The maximal tissue insulation was elevated in the winter in the diving women, indicating the development of vascular adaptation. However, it was the same as that of the nondiving females in the summer. The shivering threshold of the nondiving females was elevated as compared to the males. Moreover, the maximal tissue insulation of the nondiving females was on the average greater than that of the males. (From the author's summary)

1303
Iampietro, P. F.,
and D. E. Bass
HEAT EXCHANGES OF MEN DURING CALORIC RESTRICTION IN THE COLD. — Jour. Applied Physiol., 17 (6): 947-949. Nov. 1962.

The ability of men to maintain thermal balance during continuous cold exposure (14 days at 15.6° C., sedentary while nude) was assessed under four regimens of caloric intake: (a) adequate, 2,800 kcal./day; (b) moderate restriction, i.e., sufficient to maintain weight in a warm environment but without the added calories to support shivering, 2,600 kcal./day; (c) marked restriction, 600 kcal./day; and (d) complete starvation, 0 kcal./day. Respective weight losses for b, c, and d were 1.8, 8.2, and 12.2% body weight. With 600 and 0 kcal./day there was an impaired ability to maintain rectal temperature; under these conditions the men exhibited rectal temperatures 0.7° C. lower than when they were on adequate or nearly adequate caloric intake. The men on complete starvation had the lowest heat production of all groups during later days in the cold; however, the data were too variable to demonstrate a close relationship between depressed core temperature and decreased heat production. It is concluded that marked restriction of calories is associated with depressed core temperatures during prolonged cold exposure, due in part to absence of specific dynamic action. (Authors' abstract)

1304
Iampietro, P. F.
HEAT-INDUCED TETANY.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 884-886. May-June 1963.

Three separate groups of subjects in a fasting state underwent nine three-hour exposures to hot humid conditions for a total of 87 individual exposures. Under these conditions the sequence of events was as follows. There was initial loss of carbon dioxide (CO_2) primarily through the lungs (hyperventilation) and secondarily through the skin (sweat). This loss of CO_2 led to an increase in blood pH. When tolerance time was short these changes occurred rapidly and the incidence of symptoms (numbness of hands, feet, lips, or loss of control of movement or carpopedal spasm) was high; when tolerance time was long the same degree of change occurred, but the incidence of symptoms was low. It was therefore concluded that in the production of heat-induced tetany it was the rate of change in pH and CO_2 tension that was critical and not the absolute change. Changes in body temperature and calcium concentration were probably not important in the development of tetany since the tetany disappeared rapidly on removal from the hot room while body temperature and calcium concentration remained for a time at levels attained in the hot room.

1305
Issekutz, B.,
K. Rodahl, and N. C. Birkhead
EFFECT OF SEVERE COLD STRESS ON THE NITROGEN BALANCE OF MEN UNDER DIFFERENT DIETARY CONDITIONS. —— Jour. Nutrition, 78 (2): 189-197. Oct. 1962.

Four groups of healthy young men consumed for 10-day periods at an ambient temperature of 22° C.: 3,000 calories (Cal.), including 72 g. of protein (diet 1); 3,000 Cal., 4 g. of protein (diet 2); 1,500 Cal., 72 g. of protein (diet 3); and 1,500 Cal., 4 g. protein (diet 4), respectively. Diets 2 and 4 caused a marked loss, and diet 3 a moderate loss of body nitrogen. Changing to diet 1 during the follow-up period caused in every case a marked positive balance. The metabolic response to these four diets was investigated in nine nude subjects living for three to nine days at an ambient temperature of 8° C. This cold stress induced almost constant shivering and a resting metabolic rate about twice the basal metabolic rate (BMR). A negative nitrogen balance was observed with diet 1, and the nitrogen loss characteristic for diets 2, 3, and 4 at 22° C. was markedly increased at 8° C. After changing to diet 1 and a room temperature of 22° C. during the follow-up period, during which time the BMR was normal, the negative nitrogen balance persisted for four to six days, despite an 18-fold increase of the protein intake (in case of diets 2 and 4). It is suggested that an increased activity of the thyroid or the adrenal cortex, or both, may be responsible for this after-effect of cold exposure. (Authors' summary)

1306
Itoh, S.
ACTH CONTENT IN THE PITUITARY GLAND IN RATS UNDER CONDITIONS OF DEHYDRATION AND HEAT EXPOSURE. —— Japanese Jour. Physiol. (Kyoto), 12 (3): 257-261. June 1962.

The adrenocorticotropic hormone (ACTH) content of the anterior pituitary lobe was diminished after administration of hypertonic saline, injection of pitressin, and exposure to severe heat, whereas ACTH content in the posterior lobe was not altered by these treatments. Water deprivation as well as starvation caused a marked reduction in the ACTH content in both lobes of the pituitary gland. (Author's summary)

1307
Johnson, H. D.,
L. D. Kintner, and H. H. Kibler
EFFECTS OF 48 F. (8.9 C.) AND 83 F. (28.4 C.) ON LONGEVITY AND PATHOLOGY OF MALE RATS.—Jour. Gerontol., 18 (1): 29-36. Jan 1963.

Male rats living at an environmental temperature of 83° F. (28.4° C.) live longer than those reared at 48° F. (8.9° C.). The incidence of lesions (periarteritis nodosa, otitis media, ulcers, tail, and stomach) and testicular atrophy was much greater in the male rats living full life spans at 48° F. than in the control animals raised at 83° F. Nephritis and periarteritis nodosa were the greatest causes of death at both environmental temperatures. Cause of death from periarteritis nodosa was significantly greater in animals raised at 48° F. than in animals living full life-times at 83° F. The greater incidence of lesions of the cold-reared rats at an earlier age were associated with a far greater mortality rate. Stress and/or acceleration of aging as evidenced by postmortem analysis are discussed. (Authors' summary)

1308
Jonec, V.
[THE FACTORS INFLUENCING THE REACTION OF THE ADRENAL CORTEX TO COLD] Faktory ovplyvňujúce reakciu pody nadobličiek na chlad. —— Bratislavské lekárske listy (Bratislava), 42 (1-6):

377-388. 1962. In Slovak, with English summary (p. 387-388).

Various nonspecific factors exerted a pronounced effect on adrenocortical activity in acute cold exposure of rats and human subjects. Separation of the animals into individual cages, their transport into a room with normal temperature, tension and uncertainty before the experiment or before examination in human subjects, fear of blood sampling, seasonal adaptation, verbal preparation, etc., are all factors capable of activating the adrenal cortex to the point that the effect of the temperature change becomes obscured. The interference of these factors could be suppressed by lesions in the posterior hypothalamus; this points to an important link in the mechanism of these reactions. A dissociation of the actual cold stimulus from the associated nonspecific stimuli was achieved by means of a special apparatus (microclimator). The results of experiments on human subjects suggest a revision of the concept of "normal" levels (e.g., of plasma 17-hydroxycorticosteroids) in favor of the term "basal" levels. (From the author's summary)

1309
Joy, R. J. T.,
R. H. Poe, F. R. Berman, and T. R. A. Davis
SOME PHYSIOLOGICAL RESPONSES TO ARCTIC LIVING: A STUDY OF COLD ACCLIMATIZATION. ——Arch. Environmental Health, 4 (1): 22-26. Jan. 1962.

The process of cold acclimatization was studied in Alaska in 7 soldiers and in Greenland in 10 soldiers by measuring shivering activity, oxygen consumption, heart rate, and rectal and extremity mean skin temperature before and after 52- and 43-day respective residencies. The only significant change found was a decrease in shivering activity. This loss of the heat due to the work of shivering without a corresponding fall in heat production implies a cellular physiological-biochemical change in the body to produce the required heat for maintenance of body temperature. (Author's summary)

1310
Kandror, I. S.,
and E. I. Soltyskii
[THE FUNCTIONAL CONDITIONS AND THE MORBIDITY RATES OF A POPULATION DURING ACCLIMATIZATION IN THE EXTREME NORTH] Funksional'noe sostoianie i zabolevaemost' naseleniia v protsesse akklimatizatsii na krainem severe.—Vestnik Akademii meditsinskikh nauk SSSR (Moskva), 18 (2): 12-27. 1963. In Russian.

The accumulation of a large statistical material on the health of the population in the extreme North makes it possible to reach some generalized conclusions in regard to the various aspects of adaptation physiology. The positive aspects of adaptation are as follows: a 10-15% rise in the basal metabolic rate during cooling and a 15-25% rise in muscle metabolism during work; increased efficiency of the peripheral vascular reactions to acute cooling, and a shift in the thermal comfort zone by 2-4° C. towards higher temperature which leads to a rapid restitution of the thermal equilibrium. The negative aspects consist of a lowering of the blood pressure (especially diastolic) which manifests itself during the first years upon arrival; increased irratability of the respiratory and vascular centers; seasonal variations in the dynamics of the central nervous system; a drop in the vitamin level in the urine of adults and children and in the milk of breast-feeding mothers. The vitamin P level is lowered during most of the year with a resultant decrease of capillary resistance. The skin is more sensitive to ultraviolet radiation. The erythrocyte count is lowered in most of the children (3,500,000-4,000,000), the hemoglobin concentration reduced to 66%, and the alkaline phosphatase activity increased. The digestive capacity is lowered, frequently resulting in a negative nitrogen balance. The general immunity (phagocytic reaction) is reduced, with a corresponding decline in specific immunity. The authors conclude that adaptation occurs mainly during the first one or two years. The following tables are included: incidence of diseases related to general and nutritional factors, seasonal variations in skin capillary resistance, and physiological differences of acclimatized and nonacclimatized subjects exposed to cooling. (28 references)

1311
Karstens, A. I.
EFFECT OF WEATHER FACTORS ON AIRCRAFT MAINTENANCE CREWS IN ARCTIC AREAS.— Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238, Task no. 823802). Technical Documentary Report no. AAL-TDR-63-18, June 1963. iv+10 p.

Under conditions of dry cold with no wind, loss of aircraft maintenance crew effectiveness at temperatures down to 0°F. is small; below 0°F., outdoor maintenance performance falls off until it may reach zero for poorly motivated crews at -30°F.; better motivated crews will attain some degree of effectiveness at the lowest temperatures encountered without wind. Under conditions of dry cold with wind, outdoor maintenance usually becomes essentially ineffective when the wind chill factor is comparable to or greater than that produced by a 10 m.p.h. wind and -15°F. temperature, although some crews will perform some maintenance under these conditions. Winds in excess of 30 m.p.h. interfere with visibility due to blowing snow. It is concluded that performance could be markedly improved with adequate motivation and experience; that development of adequate face protection and of clothing less pervious to wind is feasible; and that better solutions to the problem of hand protection and dexterity under high wind chill conditions should be sought. (Author's abstract)

1312
Kaufmann, W.,
H. Nieth, and J. G. Schlitter
[THE RENAL CONCENTRATION MECHANISM UNDER EXOGENOUS HEAT STRESS] Renaler Konzentrierungsmechanimus bei exogener Wärmebelastung.—Klinische Wochenschrift (Berlin), 41 (5): 205-212. March 1, 1963. In German.

The renal concentration mechanism in response to ambient heat stress was investigated with 35 normal subjects. The studies were carried out in a climatic chamber, with the air temperatures ranging from 26 to 40° C. (relative humidity 50 to

60%, air velocity < 0,1 m./sec.). When the air temperature is raised within 30-35 minutes to 40°C. from an initial temperature of 26-27°C. and held constant for 90 minutes, the urinary output of hydrated subjects of normal circulatory, metabolic, and renal functions drops continuously to a minimum value. The effect of heat is primarily on the physical component of the thermoregulatory processes. With increasing antidiuresis the relation between osmotic concentrations of urine and plasma increases in the form of a hyperbolic function. At the same time the clearance of osmotic free water is reduced, thereby increasing the tubular reabsorption of water also in the form of a hyperbolic function. Whether or not this is an effect of the antidiuretic hormone is problematical. As the air temperature increases, the glomerular filtration rate and the total elimination of osmotically active substances are reduced. However, the excreted fraction remains unchanged which suggests that under heat stress the relationship between filtration and reabsorption-secretion of the osmotically active substances remains constant. (86 references)

1313
Keatinge, W. R.
HABITUATION TO HOT AND COLD STIMULI.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 944-945; discussion, p. 945-946. May-June 1963

"Habituation" is defined as a central nervous adjustment involved in forming a new habit or pattern of response. To demonstrate habituation, various experiments are reviewed. Human hand immersions in both cold and hot water revealed that the painful responses were reduced by repeated immersion. Diminution of response was due to central nervous control. Very lightly clothed men exposed to air at 6° C. for 7.5 hours per day showed that their immediate metabolic response was usually greater on the last than on the first day in the cold, although metabolic rate at the time they left the cold room was always less on the last than on the first day. Such changes anticipate the men's need to produce heat at these two periods of a day in the cold and represent complex central nervous adjustments. Present evidence suggests that central nervous adjustments play a large part in human acclimatization to heat and cold.

1314
Klain, G. J.,
and D. A. Vaughan
ALTERATIONS OF PROTEIN METABOLISM DURING COLD ACCLIMATION.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-03). Technical Documentary Report no. AAL-TDR-62-60, Jan. 1963. iii+15 p.

Also published in: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 862-866; discussion, p. 866-867. May-June 1963.

Cold-exposed rats were allowed to eat only as much protein as their warm mates, while obtaining extra energy requirement from carbohydrate or fat. After a four-week cold exposure, the rats were sacrificed and all livers assayed for specific enzymes involved in amino acid metabolism. Arginase and guanidoacetic acid activity in liver, kidney, and urine were higher in the cold-exposed animals than in controls. Moderate cold stress was effective in correcting and overcoming amino acid imbalances. When either isoleucine, or isoleucine and valine were omitted from the dietary amino acid mixture, growth was severely depressed in the warm groups. Omission of leucine together with isoleucine, or leucine with isoleucine and valine restored normal growth, showing that leucine excess was responsible for some metabolic alteration affecting appetite, which in turn lead to growth depression. This phenomenon was overcome by cold exposure. Cold-exposed animals increased food intake and performed as well as controls. Glutamic oxalacetic and glutamic pyruvic transaminases and arginase activity were higher in cold controls than in warm controls. Omission from the amino acid dietary mixture of isoleucine, or isoleucine plus leucine, or isoleucine plus valine resulted in a uniform increase in the activity of all three enzymes. It appears that cold-exposed animals can use an imbalanced diet for the formation of tissue proteins, by catabolizing preferentially the imbalancing portion of the amino acid mixture and utilizing it for heat production. The remaining balanced portion of the mixture may then be effectively used for protein synthesis.

1315
Klain, G. J.,
D. A. Vaughan, and L. N. Vaughan
EFFECT OF PROTEIN INTAKE AND COLD EXPOSURE ON SELECTED LIVER ENZYMES ASSOCIATED WITH AMINO ACID METABOLISM.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-03). Technical Documentary Report no. AAL-TDR-62-61, Jan. 1963. iii+7 p.

The activity of five liver enzymes involved in amino acid metabolism was found to be markedly increased in cold-exposed rats. However, the activity of three of the enzymes, arginase, glutamic-oxalacetic and glutamic-pyruvic transaminase, was increased only as a result of a cold-induced higher protein intake. In contrast, the activity of tryptophan pyrrolase and tyrosine alpha ketoglutaric transaminase was increased by cold per se. The data demonstrate that both substrate-induced and cold-induced enzymatic changes occur in cold-exposed animals. (Authors' abstract)

1316
Klain, G. J.
D. A. Vaughan, and L. N. Vaughan
INTERRELATIONSHIPS OF COLD EXPOSURE AND AMINO ACID IMBALANCES.—Jour. Nutrition, 78 (3): 359-364. Nov. 1962.
Also issued as: Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-03). Technical Documentary Report no. AAL-TDR-62-62, Jan. 1963. iii+9 p.

A moderate cold exposure was used as a tool in inducing a higher food intake in experiments dealing with amino acid imbalances in the rat. The data indicate that the rats kept at 25°C. suffer a severe metabolic disorder after ingesting amino acid imbalanced diets. In contrast, the animals kept at 7°C. readily consumed the imbalanced diets and, consequently, grew as well as the controls. The activities of the glutamic-oxalacetic and the glutamic-pyruvic transaminase were found to be increased as a result of a cold exposure. It is suggested that a moderate cold stress is an effective agent in correcting and overcoming amino acid imbalances. (Authors' abstract)

1317
Kleiber, M.

TROPHIC RESPONSES TO COLD.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 772-774. May-June 1963.

A review is presented of experiments dealing with trophic responses to cold acclimation indicating hypertrophy of the thyroid gland in chickens, liver hypertrophy in rats, change in relative organ weight, and weight regressions. Maintaining a quasi-constant body temperature, the homeotherm regulates rates of heat loss and heat production. Changing anatomical composition is an important way of acclimation to changes in environmental temperature. Outlined are Newton's law of cooling with a modification, and predictions of trophic responses to cold.

1318
Knigge, K. M.

THYROID FUNCTION AND PLASMA BINDING DURING COLD EXPOSURE OF THE HAMSTER.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 755-760; discussion, p. 760. May-June 1963.

Chronic cold exposure of the hamster at 5-7° C. for periods up to 60 days under conditions not favoring hibernation induced functional changes in thyroid activity indicating an accelerated production and release of thyroid hormone. There occurred a simultaneous increase in the amount of thyroxin stored in the gland. Maximal secretory activity appeared to occur at approximately 30 days of cold. Endogenously radiolabeled thyroid hormone and exogenously added radiothyroxin were associated only with the albumin fraction in plasma of normal and cold-exposed hamsters. During cold exposure relatively greater amounts of endogenously labeled thyroid hormone (as count/minute/milligram of albumin) were bound to a faster moving region of this fraction. (Author's summary) (58 references)

1319
Kodama, A. M.,
and N. Pace

COLD-DEPENDENT CHANGES IN TISSUE FAT COMPOSITION.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 761-765. May-June 1963

After 2-4 weeks in the cold (6° C.) the body weight loss of the hamster stabilized, as did presumably total body fat content and composition. Although all phases of adipose tissue metabolism were active during cold exposure, the diminution of fat stores resulted from a net increase in fatty acid mobilization. The striking similarities in tissue fat composition of hamsters exposed to cold, on semistarvation rations, and treated with thyroid and adrenocorticoid hormones suggest that the changes in fatty acid composition of tissue fat during cold exposure may be the result of an increased mobilization of depot fat, a mobilization which is at least partially selective with respect to individual fatty acids or triglycerides. Preliminary measurements of changes in total body fat content indicated that although the percentage of body weight loss in the three groups were comparable, the cold-exposed hamsters lost a substantially higher percentage of their body fat than did either the semistarved or hormone-treated animals.

1320
Lazarev, N. V.,
and L. P. Vartanian

[ON THE POSSIBILITY OF ENHANCING THE ADAPTATION OF THE ORGANISM TO UNUSUAL CLIMATIC CONDITIONS] O vozmozhnosti oblegchit' adaptatsiiu organizma k neprivychnym klimaticheskim usloviiam.—Gigiena truda i professional'nye zabolevaniia (Moskva), 6 (1): 21-24. Jan. 1962. In Russian, with English summary (p. 24).

A total of 462 men were exposed to climatic conditions of the North for four months. 238 of them received 10 milligrams of Dibazol daily for 10 days, and each other day for 20 days; the remaining 224 subjects served as controls. The respective morbidity rates in the test group and control group were as follows: with laryngitis and bronchitis, 24 and 62 cases; with anginas, 8 and 27 cases; the total number of patients with various afflictions, 67 and 173, respectively.

1321
LeBlanc, J.

HISTAMINE AND COLD ADAPTATION. —— Proc. Soc. Exper. Biol. and Med., 112 (1): 25-26. Jan. 1963.

Rats exposed to cold (6° C.) for one month showed a very rapid and sustained increase in urinary histamine. At the end of this period animals developed a certain tolerance to histamine aerosols. This modification in histamine excretion in the cold possibly reflects mast cell changes and the decreased sensitivity of this amine in cold-adapted animals indicates levels of secretion above physiological requirements. (Author's summary)

1322
LeBlanc, J.

SECRETION AND ACTIVITY OF HISTAMINE AND SEROTONIN DURING COLD ADAPTATION. —— Amer. Jour. Physiol., 204 (3): 520-522. March 1963.

The urinary excretion of histamine was found to rise rapidly in rats exposed to cold (6° C.). A sevenfold increase above normal was maintained during the first month of exposure, but during the second month a decline from these high values was observed, and after one year the urine histamine was within normal limits. Similarly, a marked increase in the number of mast cells in the abdominal skin was observed during the first two months of cold exposure with a return to initial values by the fourth month. The blood pressure response to intravenous histamine decreased during the first month of cold adaptation but after one year in the cold normal sensitivity to histamine was re-established. The excretion of 5-hydroxytryptamine was also rapidly increased during cold adaptation but no decline with time was observed. Whereas the urinary levels of histamine and noradrenaline show similar variations during cold adaptation, the cardiovascular response differs. The sensitivity to histamine decreased with increased excretion and the response to noradrenaline increased with increased secretion. (Author's summary, modified)

1323
LeBlanc, J.
PERIPHERAL TISSUE ADAPTATION TO COLD.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 937-939; discussion, p. 939. May-June 1963.

A review of studies dealing with peripheral tissue adaptation to cold reveal that consistent blocked mitosis and edema of the tissues caused by cold leads to a state of nonadaptation or exhaustion and necrosis plus degeneration. Electron microscope studies show the increase of layers in the stratum corneum of rats adapted to cold. Under natural conditions an increase was found of capillaries in the ears of wild rats captured during winter as compared to those captured during summer. Another aspect of cold adaptation in peripheral tissue was the increase in mast cells. There was a decrease, however, during cold injury. Excess histamine, secreted possibly by skin mast cells, was associated with marked changes in systemic histamine sensitivity to cold. The increased noradrenaline originating from outside the adrenal medulla, possibly from skin adrenergic nerve endings, was also associated with marked changes in cardiovascular and metabolic sensitivity in cold-adapted rats.

1324
Leithead, C. S.
WATER AND ELECTROLYTE METABOLISM IN THE HEAT.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 901-904; discussion, p. 904-908. May-June 1963.

Eight men walked on a treadmill at 3 m.p.h. for 30 minutes at dry-bulb air temperatures of 100° F. and wet-bulb temperatures of 85° F. with air movement of 200 feet/minute. The subjects received intramuscular injections of dl-aldosterone. Aldosterone had the desired effect of water and salt retention, for body weights increased and urinary outputs and sodium/potassium ratios diminished. An insignificant reduction was seen in sweating and pulse increment after aldosterone administration. There was apparently no change in rectal temperature increment. Human performance in heat deteriorated with the development of voluntary water depletion. Water losses are not fully replaced unless palatably cool drinking water or other fluid is taken. Salt-depletion heat exhaustion, relative salt-depletion or water intoxication, and potassium metabolism in the heat are reviewed.

1325
Lémaire, R.
[CONCERNING THE ARTIFICIAL ENVIRONMENT] A propos du milieu artificiel.—Revue de médecine aéronautique (Paris), 1 (3): 23-24. March-April 1962. In French.

Various experiments dealing with the effects of environment on human physical and intellectual efficiency are briefly reviewed. A temperature of 22° C., with a humidity of 50% is more favorable for psychomotor or mental performance than a temperature of 30° C. with 95% humidity, or 39° C. with 50% humidity. These data may be applied to aerospace medicine where the problem of maintaining defined conditions for an artificial and comfortable microclimate within the spacecraft is under study.

1326
Leslie, R. E.
THE EFFECT OF CLIMATE AND ENVIRONMENT ON THE CARDIOVASCULAR SYSTEM.—Med. Times, 91 (8): 711-723. Aug. 1963.

Accommodation to warm or cold environments is reflected by both metabolic and cardiovascular adjustments. This accommodation is of little clinical significance except for the natives of nontemperate zones. A review of the literature indicates that extremes of temperature are often associated with marked increase in the incidence and mortality of cardiovascular disease. The conclusion is warranted that changes in the external environment increase cardiac work and do affect existing cardiovascular disease. A less apparent conclusion may be drawn that the thermoregulatory mechanisms are capable of maintaining normothermia, even in the event of severe challenge. The results of meteorologic stress are reflected to a large degree on the cardiovascular system. The resulting cardiovascular strain is proportionate to the relative health of the components of that system. In the same sense, the total body resistance to external temperature is dependent upon the efficiency of thermoregulation and is limited by the stress resistance of the cardiovascular system. (Author's summary and conclusion, modified) (39 references)

1327
Lewitus, Z.
RADIOACTIVE IODINE UPTAKE IN HUMAN THYROID UNDER CONDITIONS OF HOT DESERT CLIMATE AND INDUCED HYPOTHERMIA [Abstract]. — World Assembly of the Israel Medical Association, Vth (Jerusalem, Haifa, and Tel-Aviv, Aug. 14-25, 1961), p. 92. Jerusalem: Academy of Medicine, [1962?].

The iodine-concentrating capacity of the thyroid gland was measured by the radioactive iodine uptake method. In the hot desert climate of the Negev (ambient temperature, 40° C. in the shade) a decrease was found in the iodine uptake and an increase in the plasma volume. Under hypothermia induced for surgical purposes (body temperature, 30° C.) there was an increase in iodine uptake and a decrease in plasma volume. These facts indicate that the observed changes in the iodine uptake may be due to the dilution or concentration of radioactive iodine in an increased or decreased iodine pool under the respective temperature conditions which accompany a change in extracellular volume.

1328
Lind, A. R.
A PHYSIOLOGICAL CRITERION FOR SETTING THERMAL ENVIRONMENTAL LIMITS FOR EVERYDAY WORK. —— Jour. Applied Physiol., 18 (1): 51-56. Jan. 1963.

Three subjects walked continuously on a treadmill for periods of one hour or more at 180, 300, or 420 kilocalories/hour in a range of cool and hot climates from corrected effective temperature (CET) 10-32° C. At each rate of work rectal thermal equilibrium was practically independent of the influence of environment over a wide range of climates ("prescriptive" zone); the upper limit of the prescriptive zone appeared to be associated with the minimal bodily thermal gradient compatible with the transfer of adequate amounts of heat from the core to the periphery without placing the thermoregulatory system under disproportionately increased strain, in terms of circulatory response and elevated body core temperature; as such, this seems to be one possible criterion by which thermal environmental limits for everyday work may be assessed. The upper limits of prescriptive zones for work at an energy expenditure of 300 kcal./hour is CET 27.4° C. and those for the lower and higher rates of work, respectively, were CET 30.2° C. and 26.9° C. (Author's abstract)

1329
Lind, A. R.
PHYSIOLOGICAL EFFECTS OF CONTINUOUS OR INTERMITTENT WORK IN THE HEAT. —— Jour. Applied Physiol., 18 (1): 57-60. Jan. 1963.

To define thermal limits for everyday work, a possible criterion which has been put forward described the climates ("prescriptive" climates) in which the level of bodily thermoregulation remained steady for a given rate of work. The experiments determined the effect on results, obtained from brief exposures involving continuous work, of extending the exposure to a period of 8 hours and of presenting a given total energy expenditure (2,100 kilocalories) in different patterns of work and rest. During 8-hour exposures to three climates with dry and wet bulb temperatures of 29.4 and 23.9, 36.7 and 25.6, and 41.1 and 28.3° C., respectively, two subjects expended approximately 2,100 kilocalories in both (1) a nearly continuous level of activity and (2) intermittent bouts of much harder work interspaced by longer periods of rest. The results show that extension of exposures to periods of up to 8 hours per se did not demonstrably change the levels of rectal temperature, pulse rate, or weight loss found by the second hour of exposure in the climates examined. Further, in prescriptive climates (in which the level of thermoregulation depends on the rate of work rather than on the environment), when the energy expenditure was 2,100 kilocalories in 8 hours, either continuously at a moderate rate, or intermittently at a high rate with compensatory rest pauses, the physiological cost was similar, as judged by rectal temperature, pulse rate, and weight loss. (Author's abstract)

1330
Lind, A. R.,
and D. E. Bass
OPTIMAL EXPOSURE TIME FOR DEVELOPMENT OF ACCLIMATIZATION TO HEAT.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 704-708. May-June 1963.

Four teams of young men were trained to walk on a treadmill at 3.5 miles per hour for 50, 100, or 200 minutes daily, morning, afternoon or both, respectively, in the heat for 9 consecutive days. The subjects were re-exposed to heat for 5 consecutive days after 3-17 days of no heat exposure. All teams successfully acquired acclimatization as judged by rectal temperature, pulse rate, and heat loss. A manifest difference was seen in the response of the various teams based on the duration of each bout of work. The induction and assessment of acclimatization was demonstrated to be more satisfactorily accomplished when men were required to work in the heat for a continuous period which was sufficiently long (for more than 50 minutes) to permit the eventual attainment of thermal equilibrium. The development of acclimatization appeared to depend on a raised peripheral or central tissue temperature, which stimulus must be applied for some fixed duration to elicit maximum adaptation. It is possible that the stimulus for adaptation found in acclimatization originates from thermal receptors in the periphery, the effect of which may be potentiated by elevated deep body temperatures. The thermal strain exhibited on the first few days of heat exposure was due to failure of the body to eliminate heat in adequate quantities, resulting in the continuous accumulation of heat in the body. Thermoregulatory failure was probably due to inadequate sweating responses. For periods up to 8 days there was practically no loss of the improved thermoregulation characteristic of acclimatization to heat. Included are representative tables and figures.

1331a
Lind, A. R.
PRACTICAL ASSESSMENT OF INTOLERABLY HOT CONDITIONS.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 891-892. May-June 1963.

A simple method for the assessment of intolerably hot conditions is described. The formula weighted the dry- and wet-bulb temperatures as follows: WD (weighted temperature) = 0.15d + 0.85w where d and w represent dry- and wet-bulb temperatures, respectively. The accumulation of results from mines rescue personnel in saturated and nonsaturated climates and experiments with subjects in continuous work under hot conditions gives considerably confidence to the assertion that the WD formula may be used as a practical method of relating climates of similar tolerance times. It may also be used for predicting actual tolerance times of men exposed to intolerable climates at several rates of energy expenditure.

1331b
Love, A. H. G.,
and R. G. Shanks
THE RELATIONSHIP BETWEEN THE ONSET OF SWEATING AND VASODILATATION IN THE FOREARM DURING BODY HEATING. —— Jour. Physiol. (London), 162 (1): 121-128. June 1962.

Lightly-clad, healthy, young adults recumbent in temperatures of 16-17° C. were heated by immersing their calves in water at 43-44° C. for 40-60 minutes. In the normal forearm during heating the increase in blood flow may precede, coincide with, or follow the onset of sweating. It was found that sweating always preceded or coincided with the onset of vasodilator nervous activity as inferred from a comparison of the changes in blood flow in the normal and the atropinized or nerve-blocked arm. These findings support the hypothesis that the cutaneous vasodilation in response to heating is secondary to activity of the sweat glands. There is no evidence to show separate vascular vasodilator innervation. (Authors' summary, modified)

1332
MacFarlane, W. V.
GENERAL PHYSIOLOGICAL MECHANISMS OF ACCLIMATIZATION.—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 372-382. Amsterdam: Elsevier Publishing Company, 1963

The thermal environment of man is discussed with respect to the comfort range, the effects of extreme temperatures, the thermostatic balance, and the acclimatization processes to the extremes of hot and cold. Three main components of acclimatization are distinguished: (1) sensory detection of temperature changes, (2) immediate vascular, sweating, or shivering responses via the nervous system, and (3) slower endocrine changes, modified cellular metabolism, and behavioral adjustments. Acclimatization is generally achieved within one week although it takes two to three weeks to arrive at a steady state. These changes due to acclimatization are reversible upon a change in the thermal environment, e.g., acclimatization to heat survives for two weeks in the cold. There is no cross-acclimatization between heat and cold.

1333
Macfarlane, W. V.
THERMAL IMBALANCE.—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 385-418. Amsterdam: Elsevier Publishing Company, 1963.

When man is transferred from a neutral environment around 24° C. to hotter or cooler zones, a sequence of adjustments takes place. Those that can be described from current knowledge involve all physiological "systems," under the general control of nervous and endocrine activity. Some adjustment takes place to daily thermal changes. On exposure to a persistent hot or cold environment there is an initial overswing of the functions during the first 2-3 days, followed by a return towards the initial level of cardiovascular, renal, and endocrine activity. What cannot be defined is the cellular basis for acclimatization, though there are some hints of changed concentrations of enzymes and rates of turnover of metabolites. Nor is it clear on what basis the long-term adaptations of tropical or arctic peoples rest. A complex of habituation, suitable behavior patterns, natural selection and adaptive cellular functions probably exists, for future analysis. (Author's conclusions) (292 references)

1334
McLaughlin, J. T.,
and R. R. Sonnenschein
RESPONSE OF HUMAN SWEAT GLANDS TO LOCAL HEATING.—Journ. Investigative Dermatology, 41 (1): 27-29. July 1963.

The local response of human sweat glands to direct heating does not appear to involve an axone reflex. The response is reduced, but not abolished by local anesthesia with procaine, and is thus apparently not dependent upon functional integrity of the sudomotor innervation. It is augmented by a cholinesterase inhibitor, Paraoxon (diethyl 4-nitrophenyl phosphate), and inhibited by atropine; these observations suggest that acetylcholine is involved in mediation of the response. (Authors' summary)

1335
Mallov, S.
COLD EFFECTS IN RAT: PLASMA AND ADIPOSE TISSUE FREE FATTY ACIDS AND ADIPOSE LIPASE. —— Amer. Jour. Physiol., 204 (1): 157-164. Jan. 1963.

Male albino rats were exposed to cold or kept at room temperature for 1-24 hours. Plasmas and epididymal adipose tissues were analyzed for free fatty acid (FFA) concentrations and lipolytic activities of intact sections and homogenates, as well as release of FFA by adipose tissues, determined in vitro. Plasmas of rats exposed to cold had significantly higher FFA levels than did plasmas from controls, and intact epididymal adipose tissue sections from cold-exposed rats had higher FFA concentrations, released greater quantities of FFA, and manifested higher lipase activities in the presence of activated triglyceride substrate than did sections from control rats. Exposure to cold may increase FFA mobilization from adipose tissues as a result of enhanced lipolytic activity, due to lipase activation by catecholamines released from adrenals and sympathetic nerve endings. The enzyme activated did not possess several of the properties characteristic of lipoprotein lipase. Tissue homogenates did not manifest increased activity after cold exposure, possibly as a result of activation by the homogenization process itself. (Author's abstract)

1336
Marcus, S.,
F. Miya, L. J. Phelps, and L. Spencer
INFLUENCE OF LOW AMBIENT TEMPERATURE ON RESISTANCE OF MICE TO EXPERIMENTAL COXSACKIE VIRUS INFECTION.—Univ. of Utah. Coll. of Medicine, Salt Lake City, (Contract AF 41(657-311); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8241-1). Technical Documentary Report no. AAL/TDR-62-56, April 1963. iii+16 p.

Adult albino mice were challenged intraperitoneally with Type B-1 Coxsackie virus under conditions of acclimatization and nonacclimatization to 2°C. The results show that exposure of unacclimatized mice to 2°C. results in lowered host resistance but that specific immunization is effective in protection under these conditions. Mice acclimatized to 2°C. for 40 days have increased resistance to challenge that is independent of specific immunization procedures. The mechanisms involved in protection under these circumstances remain to be explored. (Authors' abstract) (35 references)

1337
Merwe, A. le R. van der,
and K. Holemans
OBSERVATIONS ON BODY WEIGHT, BASAL METABOLIC RATE, URINARY NITROGEN EXCRETION

AND DIURESIS OF MEMBERS OF THE FIRST SOUTH AFRICAN NATIONAL ANTARCTIC EXPEDITION (SANAE I), FEBRUARY-DECEMBER 1960. —— South African Med. Jour. (Cape Town), 36 (37): 767-769. Sept. 15, 1962.

As shown by total urinary nitrogen and creatinine nitrogen percentage, nitrogen catabolism decreased with time in the majority of subjects in the Antarctic. Eight members of the group showed an increase in body weight ranging from 0.4 to 4.5 kg., while only one member lost 1.1 kg. during the 10-month observation period. These data indicate that food intake, from the caloric viewpoint, was adequate with regard to the special conditions prevailing in the Antarctic. Mean diuresis of most subjects was somewhat higher (300-400 ml. difference) than the 1.500 ml. mean value observed in temperate climates, and possibly accounted for by a decreased sweat secretion in a cold environment. Representative tables are included.

1338
Millard, W. W.
EFFECTS OF ACETYLSALICYLIC ACID ON MAN'S SKIN TEMPERATURE IN THE COLD.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238, Task no. 823801). Technical Documentary Report no. AAL-TDR-63-14, June 1963. iii+10 p.

The effect of the usual dosage of acetylsalicylic acid (aspirin) on the normal pattern of cold defense in man was investigated. Seven subjects had three exposures each at 4° C. They received ten grains of aspirin in one exposure and a ten-grain placebo in the second; the third exposure was a control with no capsule given. Results of these exposures are shown in graphs of skin and rectal temperatures. A discussion of the results is presented. The usual dosage of acetylsalicylic acid in itself appears to have no significant effect on the normal pattern of cold defense in man. There was a psychogenic reaction when a placebo or aspirin was administered. (Author's abstract)

1339
Miller, L. K.,
and L. Irving
ALTERATION OF PERIPHERAL NERVE FUNCTION IN THE RAT AFTER PROLONGED OUTDOOR COLD EXPOSURE. —— Amer. Jour. Physiol., 204 (2): 359-362. Feb. 1963.

Electrical characteristics of in vitro preparations of the ventral tail nerve were compared in rats exposed for 6 months to outdoor winter cold and control rats kept indoors at 24° C. Differences between nerves of outdoor and indoor rats were greatest at higher nerve temperatures (35° C.), becoming less at lower temperatures, until no differences were present at 5° C. Conduction velocity showed the greatest changes with cold exposure. Excitability changes could only be demonstrated with stimulus durations less than .1 millisecond. No differences in absolutely refractory period were seen between cold-exposed and control rats. In general, changes that occurred with cold exposure resulted only in a decrease in the functions examined. The results show that changes in peripheral nerve function can occur in nonhibernating mammals following prolonged exposure to climatic cold, but that these changes are not necessarily of an adaptive nature. (From the authors' abstract)

1340
Miraglia, G. J.,
and L. J. Berry
A POSSIBLE SOURCE OF SECONDARY INVADING STAPHYLOCOCCI IN SALMONELLA INFECTED MICE EXPOSED TO ACUTE COLD.—Bryn Mawr Coll., Pa. (Contract AF 41(657)-340); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 82341-1). Technical Documentary Report no. AAL-TDR-62-49, April 1963. iii+8 p.

In an effort to determine the origin of the staphylococci known to invade the deep tissues (liver, spleen, kidneys, lungs, and heart) of Salmonella-infected mice exposed continuously to 5° C. in individual compartments without bedding, the intestinal tract was freed of these organisms, as judged by absence of growth when fecal suspensions were inoculated into selective media. Substitution of 0.01 N hydrochloric acid for drinking water eliminated staphylococci within a few days, yet the incidence of tissue invasion was unaltered. The coagulase-negative strains normally present in feces and in tissues persisted in tissues even though the intestine was seeded with a coagulase-positive strain by feeding contaminated food. Cultures from the external nares continued unaltered. This suggests that the respiratory tract is a possible origin of the staphylococci found in tissues of the cold-stressed mice. (Authors' abstract)

1341
Moreigne, E.,
and P. Morand
[CONTRIBUTION TO THE STUDY OF HEAT ADAPTATION IN NAVAL UNITS] Contribution à l'étude de l'adaptation à la chaleur dans les formations maritimes. —— Revue des Corps de santé des armées (Paris), 3 (3): 349-361. June 1962. In French.

Four young adults lived for eight months in an isolated West Sahara post during cold and warm seasons. Activity (diurnally or nightly) consisted of 3 1/2 hours of physical work on a bicycle ergometer with ten-minute rest periods, and 3 1/2 hours of psychomotor tasks. Cardiac frequency at rest was always sensitive to hot climate and to the degree of acclimatization: heat induced an increase and acclimatization a decrease in frequency. Pulse rate after work was not significantly affected by heat. During the warm period the rectal temperature was lowest at noon at rest. During this same period, central body temperature after effort was lower or equal to that noted during cooler periods. During warm temperatures changes were seen in the T and ST segments of the electrocardiogram. Plotting the graphic curve of the neuromuscular excitability was difficult since it was affected by the lack of nocturnal sleep during night work. This factor, which followed a constant level during four examinations, caused hypoexcitability, more nervous than muscular, after nocturnal work and masked the effect of seasonal heat. Decreases were found in the urinary excretion of sodium, chlorine, potassium, phosphorus, calcium, and magnesium during seasonal heat increases.

1342
Northey, W. T.
STUDIES ON THE INTERRELATIONSHIP OF COLD ENVIRONMENT, IMMUNITY AND RESISTANCE TO INFECTION. I. QUALITATIVE AND QUANTITATIVE STUDIES ON THE IMMUNE RESPONSE.—Arizona State Univ. Dept. of Microbiology, Tempe (Contract AF 41(657)-386); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8241-01). Technical Documentary Report no. AAL-TDR-62-48, April 1963. iii+26 p.

Rabbits were subjected to lowered environmental temperature (4° C.), shaved of their pelage, and immunized with various protein antigens. Serum samples obtained from varying periods during each of the studies via cardiac puncture were qualitatively assayed for antibody response by Ouchterlony gel diffusion, immuno-electrophoresis, starch gel electrophoresis, and paper electrophoresis. Quantitative analyses included ring precipitin titrations, quantitative gel diffusion analysis and micro-quantitative precipitin analysis. Differences attributable to cold per se between cold-exposed and non-cold exposed animals were insufficient to draw definitive conclusions. (Author's abstract, in part)

1343
Pugh, L. G. C. E.
TOLERANCE TO EXTREME COLD AT ALTITUDE IN A NEPALESE PILGRIM [Abstract].—International Congress of Physiological Sciences, 22 (Leiden, 1962), Proceedings, vol. 2, no. 661. Amsterdam [1962?].

In winter 1961, a Nepalese pilgrim visited the base camp of the Himalayan Scientific and Mountaineering Expedition (1960-61), which was situated at 4570 meters. He came from a village at 1800 m. and was dressed in the lightweight cotton clothing worn by inhabitants of that region. He spent the following four nights in the open at heights between 4900 m. and 5500 m., with only an overcoat for protection and no footwear or gloves. Night temperatures recorded at the camp at 5500 m. during this period were -13° C. to -15° C., and on the fourth night there was a severe storm. On medical examination on the fifth day, nothing abnormal was found, there were no signs of frostbite or cold injury other than slight swelling of the feet. Two 4-hour studies of body temperature and metabolism were carried out on him at 0° C. and he was observed during a night spent in the open at an ambient temperature of -9.5° C. During the 4-hour experiments, the metabolism rose to a steady level two and a half times above resting level. Trunk temperatures remained around 33.5° C., and finger and toe temperatures fell to around +11.4° C. and +13.5° C., respectively. Muscle tensing was observed, but there was no paroxysmal shivering; urine output was less than 150 ml. After the night spent in the open, his rectal temperature was 36.0° C. compared with 35.9° C. the previous evening, and finger and toe temperatures were 22.8° C. and 22.2° C. respectively. Photographic evidence and skinfold measurements showed that he was a lean man. The significance of these findings in relation to cold acclimatization is discussed. (Author's abstract)

1344
Ramaswamy, S. S.
G. L. Dua, J. Madhaviah, G. P. Dimri, V. K. Raizada, and K. R. Vishwanathan
THE EFFECT OF VERY LOW ENVIRONMENTAL TEMPERATURE ON THE BASAL METABOLIC RATE OF HUMAN SUBJECTS.—Indian Jour. Med. Research (New Delhi), 51 (4): 688-695. July 1963.

Weekly basal metabolic rates (BMR) were taken for 9 months at 2,270 m. altitude on 15 subjects in the following three groups: (a) fully adapted to cold, (b) partially acclimatized, and (c) unacclimatized. The weekly mean temperature ranged from 4°C. to 26.5°C. for the period studied. When the ambient temperature went below 17°C., the BMR in the unacclimatized and partially acclimatized subjects showed a rise, while the fully adapted group was unaffected. The elevation in BMR in the unacclimatized subjects showed a lingering effect even after the environmental temperature started rising. On the other hand, the partially acclimatized group showed an acute response to the depression in temperature. (Authors' summary and conclusions, modified)

1345
Rimmer, A. D.,
E. Schönbaum, and E. A. Sellers
EFFECTS OF NOREPINEPHRINE ON BLOOD GLUCOSE AND FREE FATTY ACIDS IN COLD-ADAPTED RATS. —Amer. Jour. Physiol., 203 (1): 95-97. July 1962.

Norepinephrine (0.5 mg.) was given intraperitoneally to albino rats adapted to room temperature (23° C.) and to cold (2° C.). The rats were killed at selected time intervals thereafter, and the blood levels of free fatty acids (FFA) and glucose were estimated. Both groups showed an initial steep rise in blood FFA and a slight rise in blood glucose. After 1 hour the FFA levels were at their maximum in the 2° C. rats but had fallen to nearly base-line levels in 23° C. rats. Blood glucose levels remained slightly elevated for the whole 1-hour period in the 2° C. rats, but in the 23° C. rats a secondary greater rise took place toward the end of the period. Different metabolic responses follow the administration of a single dose of norepinephrine to 2° C. and 23° C. rats. (Authors' abstract)

1346
Rudnev, G. P.,
and I. P. Novikov
[PROTECTIVE HEALTH MEASURES IN THE EXTREME NORTH] Okhrana zdorov'ia cheloveka v usloviiakh krainego severa.—Vestnik Akademii meditsinskikh nauk SSSR (Moskva), 1962 (3): 83-89. 1962. In Russian.

This is the summary of a conference held in Murmansk, June 22-24, 1961. The papers presented dealt mainly with the following topics: health statistics of the Murmansk district, hygienic requirements of urban planning in the extreme North, effects of vitamin deficiency, effects of ultraviolet radiation, physiology of acclimatization, and health problems of industrial laborers and miners. The papers dealing with infectious diseases emphasize the complete absence of the following diseases: rabies, anthrax, brucellosis, malaria, tularemia, and tick-borne encephalitis. Paratyphoid and tetanus occur very seldom. The conference recommended further studies on acclimatization and problems of hygiene.

1347
Rusin, V. IA.
[THE COLD AND HEAT TOLERANCE OF ANIMALS AFTER DIBAZOL TREATMENT OR MUSCULAR TRAINING AND TEMPERATURE ADAPTATION] Resistentnost' k kholodu i templu u zhivotnykh, poluchavshikh dibazol ili podvergavshikhsia myshechnoi trenirovke i zakalivaniiu.—Fiziologicheskii zhurnal SSSR (Moskva), 49 (3): 359-365. March 1963. In Russian

A total of 100 mice were used in 5 groups of 20 animals each. Group 1 served as controls, Group 2 received 1 mg. of Dibazol per kg. of body weight a day, Group 3 was trained by swimming in water of 28-30° C., Group 4 was exposed to repeated water immersions at 16-17° C., and Group 5 received both Dibazol treatment and cold-water immersions. After the end of the conditioning the animals were exposed to a warm environment of 50° C. The muscular and temperature conditioning combined with the Dibazol treatment increased the thermal tolerance of the animals, as expressed by the lesser drop in the rectal temperature of animals of Group 5, in comparison with controls; increased tolerance to heat occurred only in the third group. The restitution of body temperature after cooling or exposure to heat was significantly faster in the test groups than in the controls. Survival times at the high temperature were as follows: 71 ± 6 min. for controls, 102 ± 12 min. for Group 2, 100 ± 16 min. for Group 3, 65 ± 7 min. for Group 4, and 109 ± 14 min. for Group 5. Tables with a statistical breakdown of the experimental data are included.

1348
Schönbaum, E.,
E. A. Sellers, and G. E. Johnson
HEAT PRODUCTION AND NORADRENALINE.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 917-919. May-June 1963.

Noradrenaline injected in high doses had an adverse effect on the ability of the rat to maintain body temperature and survive on exposure to cold (2° C.). In the rat acclimated to 2° C. no adverse effects were observed with the same dosage. Repeated hourly injections of 50 mg. noradrenaline caused hypothermia, while a single dose of 200 mg. did not materially affect body temperature. It is inferred that residual effects of the relatively small dose must remain, probably due to a gradual release of noradrenaline previously taken up by various tissues, even after the injected material was metabolized and excreted. The observed decrease in shivering of rats receiving noradrenaline, which may be related to constriction of blood vessels supplying skeletal muscle, could explain the decrease in heat production and contribute to a lethal termination. Rats receiving reserpine 24 hours before cold exposure survived, but those receiving reserpine immediately prior to cold exposure became hypothermic and many died. Oxygen consumption was increased in acclimated rats receiving noradrenaline measured at 2° C., and no hypothermic effect occurred.

1349
Sellers, E. A.,
and E. Schönbaum
CATECHOLAMINES IN ACCLIMATION TO COLD: HISTORICAL SURVEY.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 909-910. May-June 1963.

A brief review is presented of studies of the sensitization of cold-acclimated rats to the effects of noradrenaline. Cold-acclimated rats respond to noradrenaline with a greater increase of cardiac output than nonacclimated controls. From a work investigating tissue levels and catecholamine excretion in cold acclimation, it was seen that maximal urinary excretion of catecholamines takes place one week after exposure of the rat to cold and therefore does not coincide with maximal metabolic response to noradrenaline, which reportedly was seen four weeks after cold exposure. Cold-acclimation can occur while tissue levels of noradrenaline are very low. Noradrenaline reportedly acts not only at the postganglionic adrenergic nerve terminal, but at ganglia and even the neuromuscular junction. Two major effects of acclimation on autonomic sympathetic function described are: (1) an increased response to noradrenaline, and (2) an increased excretion of noradrenaline.

1350
Shcherbakov, IU. A.
[SECRETION OF PANCREATIC ENZYMES UNDER CONDITIONS OF HIGH AMBIENT TEMPERATURE IN RESPONSE TO VARIOUS FOOD STIMULI] Vydelenie pankreaticheskikh fermentov v usloviiakh vysokoi vneshnei temperatury v otvet na razlichnye pishchevye razdrazhiteli. — Voprosy pitaniia (Moskva), 21 (3): 61-66. May-June 1962. In Russian, with English summary (p. 66).

There is a considerable depression of pancreatic secretion in dogs maintained at a high ambient temperature and insolation. Solar (thermal) overheating causes the amylase concentration in the pancreatic juice to rise, increasing the total amount of the secreted amylase. Similarly chemotrypsin and lipase are secreted in higher concentrations than at room temperature; the total amount of these enzymes, however, tends to decrease. These changes are less pronounced if the animals are fed a milk diet rather than a meat diet. (From the author's summary)

1351
Slonim, A. D.
NERVOUS MECHANISMS OF COLD ACCLIMATION.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 732-736. May-June 1963.

A review is presented of animal experiments dealing with cold acclimatization. Division of the individual and special phenomena of cold acclimation of homeothermic organisms into three stages enables a delineation of their general regularities and an evaluation of the underlying physiological mechanisms. The first stage of acclimation is characterized by the fact that sudden cold action does not elicit marked thermoregulatory reactions, either chemical or physical. The second stage is distinguished by formation of conditional reflexes to cold when the gas metabolism is greatly increased and the latent period of chemical thermoregulation is decreased under repeated cooling. The third stage of cold acclimation is marked by diminution of cold reaction, adaptation of receptors, and greater stability of body temperature under cooling. The duration of these stages depends on special or hereditary peculiarities of the animal and the intensity of the cooling. (Author's conclusions, modified) (41 references)

1352
Smith, Robert E.,
and D. J. Hoijer
METABOLISM AND CELLULAR FUNCTION IN COLD ACCLIMATION. — Physiol. Reviews, 42 (1): 60-142. Jan. 1962.

A comprehensive review is given of the physiological responses on the cellular level in mammals during cold acclimation. Neural and neuralhumoral regulation is reviewed in respect to various endocrine glands, trophic responses, and general neurological relationships. The effects of cold stress on protein, lipid, and carbohydrate metabolism as well as aspects of energy production in intermediate metabolism are discussed. A discussion of mitochondrial structure and extramitochondrial components in relation to terminal electron transport is given. The authors' conclusion are presented. (667 references)

1353
Smith, Robert E.
COFACTOR OPERATORS UNDER NEUROHUMORAL CONTROL.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 738-741; discussion, p. 741-742. May-June 1963.

Metabolic adjustments to chronic cold exposure furnish examples of an overlying neurohumoral control system which achieves an autoregulation through an ordered sequence of hormonal dominance over key metabolic processes. The latter derive negative feedback potential through hydrogen exchange and redox activities of such cofactors as the pyridine nucleotides, adenosine triphosphate, ascorbic acid, coenzyme A, and an adequate supply of dietary precursors such as nicotinate, pyridoxal phosphate, and essential components of other vitamins and substrate materials. Specific processes include: the glycolytic and lipolytic action of catecholamines; the thyroid-activated enzymatic reduction of triphosphopyridine nucleotide (TPN); enhancement of mitochondrial α-glycerophosphate dehydrogenase and phospholipid synthesis, together with inhibitory effects on the TPNH-DPN transhydrogenase; and corticosteroids through their specific reductases also mediate transhydrogenase activity. Although the TPNH and DPNH may respectively favor extra- and intramitochondrial oxidations, the former appears the more likely thermogenic operator in view of its microsomal-soluble position and probable capabilities for a nonphosphorylative coupling with molecular oxygen, i.e., reactions in which work functions are relatively small compared to those of phosphorylative pathways. (From the author's summary) (22 references)

1354
Sochański, R.,
and D. Samek
[THE CONCENTRATION OF 5-HYDROXYTRYPTAMINE IN THE HINDBRAIN OF MICE EXPOSED TO HIGH TEMPERATURE] Poziom 5-hydroksytryptaminy w tyłomozgowiu myszy poddanych działaniu wysokiej temperatury. — Acta physiologica polonica (Warszawa), 13 (3): 407-411. May-June 1962. In Polish, with English summary (p. 411).

The concentration of 5-hydroxytryptamine (5-HT) was determined in the hindbrain of mice exposed to high temperature in order to ascertain whether under these conditions the known parallelism in behavior of catechol amines and indole amines prevails. The hindbrain was selected because it has been shown that its catechol amine level falls upon exposure to heat. In the controls the concentration of 5-HT was 0.31 μg./g. It fell in the experimental animals to 0.19 μg./g. This suggests that a rise of brain temperature has an adverse effect on an enzyme or enzyme system which the catechol amines and indole amines have in common. (Authors' summary, modified)

1355
Sohar, E.,
T. Gilat, R. Adar, J. Kali, D. Yaski, and
B. Givoni
[THE EFFECT OF PHYSICAL EFFORT AND EXTERNAL HEAT LOAD ON BODY TEMPERATURE] Hashpa'at ma'amats gufni ve-omes hom al tempraturat ha-guf. — Harefuah (Jerusalem-Tel Aviv), 63 (1): 6-8. July 1, 1962. In Hebrew, with English summary (p. 8-9).

Nine normal well-acclimatized youths were subjected to physical work at three different levels of energy expenditure under varying controlled conditions of environmental heat in a climatic chamber. Sweat rates were measured throughout the experiment, which lasted 2 hours until the subject was exhausted, or until the rectal temperature reached 39.9° C. Rectal temperature curves revealed (1) a horizontal curve indicating no rise in body temperature during effort; (2) an initial rise and then a continued plateau; or (3) a steep rise reaching the safety limit (39.9° C.) in about a half hour. Several experiments demonstrated the respective effect of external heat load and physical effort on the rectal temperature curves. It is suggested that heatstroke results when the body fails to dissipate all the heat produced internally. Positive heat balance causes a rise in body temperature, and the eventual cessation of sweating is thought to be the result and not the cause of hyperpyrexia. Prevention of heatstroke consists of avoiding the combination of extreme physical work in hot climates. A state of optimal hydration of the body should be maintained by sufficient fluid intake. (Authors' summary, modified)

1356
Stoner, H. B.
CARBOHYDRATE METABOLISM IN SOME PATHOLOGICAL CONDITIONS AND IN THE COLD.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 851-855. May-June 1963.

Total oxygen consumption reduced after injury (bilateral hind limb ischemia) increased in the rat exposed to cold. Shivering absent in the cold injured rat was seen on cold exposure. When the environmental temperature of the unanesthetized rat was reduced to 3° C., the temperature of the liver, which is an important site of heat production, rose without significant change in blood flow. Although noradrenaline was secreted in both cases, it was unlikely that there was major secretion of adrenaline during the first few hours after cold exposure. This may explain some differences in carbohydrate metabolism. Blood glucose increased during trauma and decreased slightly during cold. In both the cold and injured rat, muscle and liver glycogen were reduced, however glucose oxidation and heat production were reduced in injured animals but increased in those exposed to cold. Carbohydrate metabolism in cold acclimated rats was not grossly altered. However, the turnover and oxidation of glucose was increased in both fed and fasted rats at 30° C. Cold acclimated rats were not only resistant to cold but also to physical injury. The full extent of the protection afforded by previous cold acclimation has not been studied.

1357
Strydom, N. B.,
and C. H. Wyndham
NATURAL STATE OF HEAT ACCLIMATIZATION OF DIFFERENT ETHNIC GROUPS.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 801-808; discussion, p. 808-809. May-June 1963.

Males from various populations were subjected to four hours of heat (90° F.) in a climatic tent. Work consisted of stepping on and off an adjustable step at a rate of 12 steps/minute. Caucasians living and working in desert and tropical environments were partially acclimatized to heat. They did not differ from each other or from the local inhabitants of such areas in their physiological reactions to heat except that the white Australians tended to sweat significantly more than the Aborigines. Caucasians living in the temperate climate of Johannesburg showed no signs of partial heat acclimatization and differed significantly in observations on rectal temperature, pulse rate, and sweating. In their natural state the Bushmen, Aborigine, Arab, and Bantu groups all showed partial heat adaptation. They did not differ from each other in body temperature response to heat stress but Bushmen had pulse rates significantly lower than the other groups. Sweat rates of Arabs and Bushmen, both living in desert conditions were significantly higher than those of natives from tropical and temperate regions. Bantu and white South African groups differed markedly from each other in their natural state of acclimatization, the latter group showing higher rectal temperatures and pulse and sweat rates during heat stress. These differences disappeared following acclimatization except for higher sweat rates among whites during the last two hours. (Authors' summary, modified)

1358
Strydom, N. B.,
C. H. Wyndham, H. M. Cooke, J. S. Maritz, G. A. G. Bredell, J. F. Morrison, J. Peter, and C. G. Williams
EFFECT OF HEAT ON WORK PERFORMANCE IN THE GOLD MINES OF SOUTH AFRICA.—In: Proceedings of the International Symposium of Temperature Acclimation. Federation Proceedings, 22 (3, part I): 893-896. May-June 1963.

Two men were heat-acclimated at wet-bulb temperatures of 86-87° F. and at 90-91° F. The subjects shoveled rock into mine cars during a five-hour shift at wet-bulb temperatures ranging from 81 to 96° F. with wind velocities of about 100, 400, or 800 feet/minute. A relationship was found between work performance and wet-bulb temperature in the range of 81-96° F. which was influenced far more when the wind velocity was changed from 100 to 400 ft./min. than when changed from 400 to 800 ft./min. No great advantage was seen in working at wind velocities higher than 400 ft./min. except perhaps at high wet-bulb temperatures, i.e., 93-94° F. and above. This finding is of practical importance when considered in relation to the cost of providing various levels of wind velocity in working places. Statistical analysis of oral temperatures indicates that even at the relatively low rates of work achieved at higher wet-bulb temperatures the risks of heat stroke are high, particularly at the wind velocity of 100 ft./min. Performance data of laborers hyperacclimatized by exposure to a third stage at 93° F. after normal acclimatization procedures at a single wind velocity of 100 ft./min. showed no significant departures from those of normally acclimatized subjects tested at the same wind velocity.

1359
Strzoda, L.
[THE EFFECT OF HIGH AMBIENT TEMPERATURE ON THE CENTRAL NERVOUS SYSTEM: CHANGES IN THE CONCENTRATIONS OF NORADRENALINE AND ADRENALINE IN THE BRAIN STEM OF ANIMALS EXPOSED TO HIGH TEMPERATURES] Wpływ wysokich temperatur otoczenia na ośrodkowy układ nerwowy: zmiany w stężeniu noradrenaliny i adrenaliny w pniu mózgu zwierzęcia poddanego działaniu wysokiej temperatury. —Acta physiologica polonica (Warszawa), 13 (2): 253-262. March-April 1962. In Polish, with English summary (p. 261-2).

Extracts of diencephalon and rhombencephalon preparations from mice exposed to high ambient temperatures were assayed for their adrenaline and noradrenaline content. The results indicate a decrease in adrenaline and noradrenaline concentrations in the rhombencephalon and an increase of these in the diencephalon as compared to the controls. This suggests a connection between the effects of high temperature on the central nervous system, the metabolism of catechol amines, and the activity of the vasomotor center. (Author's summary, modified)

1360
Sulman, F. G.,
N. Hirschfeld, and J. Pfeifer
[EFFECT OF HOT DESERT WINDS (SHARAV, HAMSIN) ON THE METABOLISM OF HORMONES AND MINERALS] Hashpa'at ha-sharav al ha-mitabolism shel hormonim u-mineralim. —Harefuah (Jerusalem-Tel Aviv), 63 (1): 1-4. July 1, 1962. In Hebrew, with English summary (p. 4-5).

The urinary hormone and mineral level of 8 scientists was studied for 4 years under sharav conditions and compared with that obtained under normal climatic conditions. The excretion of 5-hydroxyindole acetic acid, 17-ketosteroids, and sodium was decreased, while the excretion of 17-hydroxycorticosteroids and potassium was increased during the sharav. Adrenaline and noradrenaline excretion differed between veteran residents and new immigrants: an increase was noted among the newer arrivals and a decrease among old-timers and native-born Israelis. (From the authors' summary)

1361
Sulman, F. G.,
N. Bar-Joseph, and N. Hirschmann
ROUTINE METHOD FOR DETERMINATION OF URINARY 17-HYDROXYCORTICOIDS AND ITS APPLICATION IN DIFFERENT DISEASES AND IN HEAT STRESS. —— Israel Med. Jour. (Jerusalem), 21 (9): 220-224. Sept.-Oct. 1962.

Daily 17-hydroxycorticoid (17-OHC) excretion was studied in five normal persons during spring and autumn in order to determine their reaction toward heat stress (sirocco). Five hundred examinations (tabulated) indicated a considerable increase in 17-OHC excretion on hot days (up to 35%) in four out of five persons. No difference was found in 17-OHC excretion between native-born persons, immigrants, and old-timers.

1362
Teichner, W. H.,
and E. Youngling
ACCLIMATIZATION, HABITUATION, MOTIVATION, AND COLD EXPOSURE. —— Jour. Compar. and Physiol. Psychol., 55 (3): 322-326. June 1962.

Five groups of rats were acclimatized to approximately optimum physiological temperature conditions and then trained to shock escape for varying numbers of days before being trained further in a cold environment. A sixth group was both acclimatized and trained in the cold. The results permitted an empirical distinction between the physiological process of acclimatization and the psychological process of habituation. The following conclusions appear to be warranted: (1) The response strength and the metabolic rate of cold-acclimatized rats are greater than those of rats acclimatized and trained under optimum temperature conditions; this is consistent with a theoretical approach involving a generalized drive strength concept based on metabolic rate as an underlying factor. (2) Within the limits studied, response strength in a changed thermal environment relative to prechange strength is inversely related to the amount of practice obtained in the original environment. (Authors' summary, modified)

1363
Thompson, E. M.,
and M. A. Knight
EFFECT OF HIGH ENVIRONMENTAL TEMPERATURE ON BASAL METABOLISM AND CONCENTRATIONS OF SERUM PROTEIN-BOUND IODINE AND TOTAL CHOLESTEROL.—Amer. Jour. Clinical Nutrition, 13 (4): 219-225. Oct. 1963.

Basal metabolism of women, but not of men, diminished significantly in summer. Serum protein-bound iodine and total cholesterol in women remained unchanged; in men, protein-bound iodine levels diminished in summer from high normal to low normal levels and total cholesterol levels diminished 9%. These observations may have been influenced in some measure by differences in daily routine, stresses due to exposure to open sunshine and extremes in weather, and inability of men to adjust to lower levels of basal energy exchange such as occurs in women. These inverse relations to temperature may have resulted from changes in hemoconcentration or intercellular and intracellular water distribution. Because of the relatively large variations in blood serum cholesterol levels observed from day to day, diagnoses based on single observations may be wholly unreliable. (Authors' conclusions)

1364
Tikhomirov, I. I.
[ON SOME PHYSIOLOGICAL CHANGES IN THE HUMAN ORGANISM IN THE PROCESS OF ACCLIMATIZATION IN THE CONTINENTAL REGIONS OF ANTARCTICA] O nekotorykh fiziologicheskikh sdvigakh v organisme cheloveka v protsesse akklimatizatsii vo vnutrimaterikovykh raionakh Antarktidy.—Vestnik Akademii meditsinskikh nauk SSSR (Moskva), 1962 (3): 74-82. 1962. In Russian.

A summary is presented of observations on the physical conditions of members of the Antarctic expeditions of 1957 and 1959. The stations Vostok-1 and Vostok-2 were exposed to the following environmental factors: barometric pressure equivalent to 4000 m., humidity near 0% in winter and 0.35% in summer, average wind velocity 5-10 m./sec., and average annual temperature -55.4° C. In general, the adaptation reactions were divided into three distinct phases: The first phase began immediately upon arrival and was characterized by general weakness, nausea, and dyspnea. Objective examinations revealed the presence of cyanosis, moderate tachycardia, and tachypnea. The second phase, which began 14 days after the first one and lasted several months, was marked by the subjective symptoms of fatigue, insomnia, lack of appetite, constipation, meteorism, and sometimes cardiac pains. The majority of the expedition members also suffered from weakness and neurasthenia. The onset of the third phase usually coincided with the termination of the polar night and was characterized by the general alleviation of the above symptoms. In all subjects, an increased hemoglobin and erythrocyte count was observed, while the leukocyte count approached limits below the norm. The following graphs and charts are included: changes in systolic and diastolic pressure and pulse rates, changes in systolic pressure during physical exercise, and respiration rates and volume of pulmonary respiration, —all during an eleven-month period—; also, oxygen and CO_2 content in the alveolar air at rest, oxygen content of blood, and fluctuations in body temperature. Changes in blood morphology are tabulated.

1365
Vasil'eva, A. V.
[CHANGES IN ELECTRICAL ACTIVITY OF THE HEART DURING WORK AT HIGH ENVIRONMENTAL TEMPERATURES] Izmenenie elektricheskoi

aktivnosti serdtsa u rabochikh pri vypolnenii fizicheskoi raboty v usloviiakh vysokikh temperatur. — Fiziologicheskii zhurnal SSSR (Moskva), 48 (6): 706-711. 1962. In Russian.

Electrocardiograms of laborers were taken before, after, and several times during the work in the regeneration chambers of open-hearth furnaces. The ECG changes recorded during the work at high environmental temperatures bordered on the pathological. The most important of these were hyperthrophy of the right ventricle, coronary deflection of the T wave, and changes in the excitability of auricles.

1366
Vaughan, D. A.,
L. N. Vaughan, and G. J. Klain
THE POST COLD BEHAVIOR OF RIBOFLAVIN DEFICIENT RATS.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-18). Technical Documentary Report no. AAL-TDR-62-27, July 1962. iii+11 p.

The post-cold behavior of riboflavin-deficient rats was studied. It was observed that rats depleted at 5° C. for four weeks resumed slow growth (due to fat and water deposition) upon return to 25° C. Gross symptoms of the deficiency did not appear as soon in the post-cold rats as in the warm rats. Total riboflavin losses from the liver were rapid initially, leveling out at about one-third of normal concentration, but there was little difference between groups. Liver and kidney xanthine oxidase activity did not fall as rapidly as did riboflavin, and the post-cold rats appeared to maintain higher levels throughout the experiment. (Authors' abstract)

1367
Veghte, J. H.
EFFECTS OF PARTIAL COLD WATER IMMERSION SION ON MAN IN THE ARCTIC.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238, Task no. 823801). Technical Documentary Report no. AAL-TDR-63-24, June 1963. iii+11 p.

Experiments were conducted to determine how critical a hazard to man partial cold water immersion would be during the Arctic winter and how long a time would be available before frostbite could be expected. At ambient temperatures ranging from -2° to -45° F., subject's right leg was immersed to the knee in water for 10 seconds, after which the subject either stood at rest or exercised. Twenty-four skin temperature measurements were recorded every two minutes, and experiments were terminated when any skin temperature reached 40°F. Data indicate that footgear should not be removed after accidental partial cold water immersion and that, even with no activity, a person has approximately 30 minutes before any danger of frostbite occurs. Exercising or walking greatly prolongs tolerance time and, even at very low temperatures, one may walk for hours before the foot temperature becomes dangerously low. (Author's abstract)

1368
Weiss, A. K.
THE EFFECTS OF AGE AND ARTIFICIAL ACCLIMATIZATION ON THE SURVIVAL OF RATS IN COLD.—Internat. Jour. Biometeorol. (Bern), 6 (1): 49-53. Nov. 1962.

Clipped, young Holtzman rats can be made to withstand cold exposure of 5° C. as a result of adaptive mechanisms which are activated during pre-acclimatization. These mechanisms are less pronounced in clipped mature rats and seem to decline with age. Where inherent adaptive mechanisms are unable to allow the rat to withstand exposure to 5° C., treatment with thyroid hormones seems to impart an artificial acclimatization which permits the survival of mature as well as of old, clipped rats in the cold. (Author's abstract)

1369
Wing, J.,
and R. M. Touchstone
A BIBLIOGRAPHY OF THE EFFECTS OF TEMPERATURE ON HUMAN PERFORMANCE.—Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171002). Technical Documentary Report no. AMRL-TDR-63-13, Feb. 1963. iv+19 p.

This bibliography lists technical reports and journal articles dealing with human performance under both high and low ambient temperatures. The articles and reports have been grouped into sections covering five major performance areas: (1) Sensory Thresholds and Simple Reaction Time, (2) Attention and Perception, (3) Psychomotor Performance, (4) Heavy or Prolonged Physical Work, and (5) Mental Performance. A sixth section of the bibliography lists references which review portions of the literature. All the references have been coded as to whether they deal primarily with the effects of high or low ambient temperatures. An author index is included. (Authors' abstract) (162 references)

g. Sound, Noise, and Vibration

[*Protective devices under 10-b; Effects of noise on hearing under 4-c; Noise characteristics of aircraft under 11-b*]

1370
Adey, W. R.,
W. D. Winters, R. T. Kado, and M. R. Delucchi
EEG IN SIMULATED STRESSES OF SPACE FLIGHT WITH SPECIAL REFERENCE TO PROBLEMS OF VIBRATION.—Electroencephalography and Clinical Neurophysiol. (Amsterdam), 15 (2): 305-320. April 1963.

The effects of shaking on the electrical brain activity as recorded in cortical and subcortical structures of four pig-tailed macaques are described. Shaking was performed over a continuous spectrum from 5-40 cycles per second, at a peak acceleration of 2 g over the greater part of the spectrum. Driving of brain rhythms at the shaking frequency was noted in the midbrain reticular formation, the nucleus centrum medianum, the visual cortex and the hippocampal system. An essentially different distribution of driving was produced by photic stimulation. The driving was maximal in the frequency range from 9-15 c.p.s. At frequencies from 15 to 20 c.p.s., evidence was found of driving at half the shaking frequency. The driving was frequently dissociated in simultaneous records from adjacent brain structures, and from leads in symmetric bilateral placements. Concurrent behavioral performance in an oddity-discrimination test indicated an increase in errors, lack of attention, and longer latency of responses at shaking frequencies around 11 c.p.s., associated with maximal rhythmic EEG driving. An isolated instance of seizure induction during shaking under pentobarbital anesthesia is described. Special requirements for EEG recording in manned space flight are discussed. (Authors' summary, modified)

1371
Arkad'evskii, A. A.
[HYGIENIC STANDARDS FOR CONTINUOUS HIGH-FREQUENCY NOISE] Gigienicheskoe normirovanie nepreryvnogo vysokochastotnogo shuma. — Gigiena i sanitariia (Moskva), 27 (2): 25-28. Feb. 1962. In Russian, with English summary (p. 29).

Seven subjects with normal hearing were exposed to continuous noise in the range of 800-1600 c.p.s. at intensity levels of 70, 75, and 85 decibels. Physiological indices determined before, during, and after noise exposure were: audiometric registration of hearing acuity, electrocardiogram, visual-motor reaction time, and changes in arterial pressure. Judged by the marked shifts in the physiological functions and their retarded return to the original values, continuous high frequency noise at an intensity of 85 decibels has a detrimental effect on men during work. Noise of the same frequency characteristics but at lower intensities results in insignificant changes along the same physiological parameters which rapidly revert to initial levels. (From the author's summary)

1372
Babkoff, H.,
and S. Sutton
EFFECT OF NOISE ON DICHOTIC TEMPORAL RESOLUTION [Abstract].—Jour. Acoust. Soc. America, 35 (5): 777. May 1963.

The effect of broad-band (125-8000 c.p.s.) background noise on the dichotic temporal interval between two clicks required to report them as two was investigated. As noise level is increased up to 30 decibels (re monaural threshold), the dichotic temporal interval required for a report of two (Δt) is decreased. For noise levels from 30-50 decibels, the dichotic temporal interval for a report of two increases. The extent of this reversal seems related to mask level, although the effect of noise in decreasing Δt is not related to signal-to-noise ratio. With narrow-band low-pass noise, the Δt required for a report of two continues to decrease as noise level increases up to 50 decibels, whereas a narrow-band high-pass noise shows the same reversal as does the broad-band noise. Increasing the click level without adding any background noise decreases the Δt required for a report of two. (Authors' abstract)

1373
Beaupeurt, J. E.
A STUDY OF THE EFFECTS OF VIBRATION ON HUMAN PERFORMANCE. — Naval Research Reviews (Washington), 1962 (Aug.): 12-17. Aug. 1962.

Three phases are described of low-frequency vibration studies (to identify specific frequencies and other characteristics which hinder or prevent crews from doing their jobs) carried out by the Office of Naval Research and the Boeing Company, as well as a special facility designed and built at the Boeing plant in Wichita, Kansas. The phases described include: (1) the initial experiment which provided a standard frame of reference for determining the effects of various intensity-frequency combinations (ranging between 1 and 27 c.p.s.) to be applied in future tests, (2) vibration effects on human performance (vision, hearing, speech, motor skills), and (3) the effects on performance of integrating tasks. The last phase (now getting underway) is expected to provide the "missing link" in a great deal of data. The feasibility of correlating effects of sinusoidal (used in tests described) and random (found in operational situations) vibrations is mentioned briefly.

1374
Bershtein, S. A.
[CHANGE IN THE HEMOLYTIC RESISTANCE OF ERYTHROCYTES UNDER THE EFFECT OF ULTRASONIC RADIATION] Zmina hemolitychnoi stiikosti erytrotsytiv pid vplyvom ul'trazvukovoho oprominennia. — Fiziologichnyi zhurnal (Kyiv), 8 (2): 238-242. March-April 1962. In Ukrainian, with English summary (p. 242).

A suspension of erythrocytes at standard concentration was irradiated on a VEM ultrasonic apparatus at a frequency of 800 kc.p.s. Photoelectric investigation of the kinetics of hemolysis (I. A. Terskov and I. I. Gitelson) showed that the hemolysis of erythrocytes is preceded by early, probably structural, changes expressed as a fall in the resistance of the erythrocytes. A definite correlation was established for the fall in the resistance of erythrocytes under the effect of ultrasonic vibrations of varying intensity. (Author's summary, modified)

1375
Bershtein, S. A.
[ON THE EFFECT OF ULTRASOUND ON SOME MORPHOLOGICAL AND PHYSICO-CHEMICAL INDICES OF THE PERIPHERAL BLOOD] Pro vplyv ul'trazvuku na deiaki morfologichni ta fizyko-khimichni pokaznyky peryferychnoi krovi.— Fiziologichnyi zhurnal (Kyiv), 9 (3): 369-376. 1963. In Ukrainian, with English summary (p. 376).

The lumbar region of 70 rabbits was exposed to ultrasound of the intensities of 3 watt/cm.^{2}, 1 w/cm.^{2}, or 0.3 w/cm. for periods up to 15 min. As a rule the erythrocytic stability was decreased following a single exposure, with more pronounced hemolysis occurring after more intense irradiation. The erythrocyte and the leukocyte count was lower than in controls, while the number of reticulocytes was higher. Repeated exposures to ultrasound of low intensity (1 w/cm.^{2} and 0.3 w/cm.^{2}) did not aggravate changes observed after a single exposure.

1377
Calearo, C.,
G. P. Teatini, and G. Pestalozza
SPEECH INTELLIGIBILITY IN THE PRESENCE OF INTERRUPTED NOISE. — Jour. Auditory Research, 2 (2): 179-186. April 1962.

The intelligibility of speech in the presence of interrupted noise has been investigated. Under the same experimental conditions, intelligibility in the presence of interrupted noise is better than in the presence of continuous noise. Intelligibility scores decrease as interruption rates increase and as the signal-to-noise ratio decreases. Intelligibility becomes worse at high intensity levels of noise for the same signal-to-noise ratio. The intelligibility of speech in the presence of interrupted masking is entirely different from the intelligibility of interrupted speech although they may show casual similarities. The difference is due to the temporary threshold shift caused by the short-duration fatigue following the bursts of noise. (Authors' summary)

1378
Caporale, R.,
and M. De Palma
[THE EFFECT OF HIGH-INTENSITY NOISE ON THE HUMAN ORGANISM: A RHEOGRAPHIC STUDY] L'azione dei rumori di elevata intensità sull' organismo umano: indagine reografica.—Rivista di medicina aeronautica e spaziale (Roma), 26 (2): 273-290. April-June 1963. In Italian, with English summary (p. 286).

Thirteen young (age 20-22), healthy subjects with normal hearing function were exposed in the supine position to white noise of 110 decibels. The circulation in the forearm was rheographically recorded (by registering the electrical conductivity) and the electrocardiogram from a peripheral lead was taken during the sound stimulation of 3 minutes and for five minutes after sound exposure. The heart rate was only insignificantly affected while the pulse amplitude and flow index increased in the 10 seconds following the beginning of stimulation. After this initial period the values decreased again toward control values. The observed vasomotor phenomena are basically the same as those observed as a typical defense reaction to harmful stimuli.

1379
Caporale, R.
[ON SOME ASPECTS OF HEARING PROTECTION OF AVIATION TECHNICIANS AGAINST NOISE] Su alcuni aspetti della protezione acustica del personale specialista dell'aeronautica contro i rumori.—Rivista di medicina aeronautica e spaziale (Roma), 26 (3): 464-477. July-Sept. 1963. In Italian, with English summary (p. 475).

Methods of noise-level and noise-spectrum measurements applicable to aviation noises are reviewed. The noise field of an F-104 (jet fighter) plane is analyzed and graphically presented. Methods of testing individual sound-attenuating devices (ear muffs, ear plugs, helmets) are briefly discussed.

1380
Chadwick, D. L.
ACOUSTIC TRAUMA--SOME INVESTIGATIONS CONCERNING INDUSTRIAL NOISE.—Jour. Laryngology and Otology (London), 77 (6): 467-479. June 1963.

The hearing of workers in an unusually noisy environment was studied for a period of over two years. The noise source was a jet-engine, running in an enclosed space and producing (1) a high-intensity over-all noise and (2) isolated peaks of very high sound-pressure levels. The sound spectrum was such as to be capable of producing both chronic "noise-induced deafness" and acute "acoustic trauma". The noise exposure was a continuous 6 hours daily. Audiometric studies indicated a more initial high-tone loss and a much more pronounced permanent threshold shift than in an otherwise comparable control group. The role of past otitis media on the development of inner-ear lesions was studied. The findings suggest that there may be critical sound pressure levels and frequencies, below which middle-ear lesions may protect the cochlea, but above which the effects of harmful noise become grossly accentuated. (Author's summary and conclusions) (32 references)

1381
Clark, W. S.,
K. O. Lange, and R. R. Coermann
DEFORMATION OF THE HUMAN BODY DUE TO UNI-DIRECTIONAL FORCED SINUSOIDAL VIBRATION.—Human Factors, 4 (5): 255-274. Oct. 1962.

The effects of forced vibration upon the human body were determined in the form of circumferential strain of chest, abdomen, pelvis and thigh. Sixteen human subjects, in the sitting erect, sitting relaxed and semi-supine positions, were exposed to vertical sinusoidal frequencies above two cycles/second at vector accelerations below 1 g. The maximum body strain occurred at 6.7 c./s. in the semi-supine position and between 4 c./s. and 6 c./s. in the sitting positions. In the semi-supine position the mean strain of chest and abdomen at resonance was found to be 0.040 and 0.053 inch/inch/g, respectively, when standardized to a table acceleration of 1 g. In the sitting positions this strain was only half as large. The strain of the pelvis, on the other hand, was 0.013 in./in./g in the semi-supine posture, and 0.032 in./in./g in the sitting positions. All subjects showed maximum body strain near 7 c./s. in the semi-supine posture. Since tolerance to vibration decreases with increasing body strain, the human body on a space couch must be protected against vibrations transverse to the couch axis in the range around 7 c./s. (Authors' abstract)

1382
Coermann, R. R.
THE MECHANICAL IMPEDANCE OF THE HUMAN BODY IN SITTING AND STANDING POSITION AT LOW FREQUENCIES.—Human Factors, 4 (5): 227-253. Oct. 1962.

The theory of the mechanical impedance of systems with one or more degrees of freedom is applied to the human body. A method of measuring mechanical impedance and determining the parameters of the vibrating systems is developed. Impedance curves for longitudinal vibrations of a sitting and standing subject are established for the frequency range of 1 to 20 cycles/second. The influence of varied posture and restraining systems is investigated. Dynamic movements of body parts are measured, directly or indirectly, and compared with the impedance curves. The responsible elements in the body for the apparent resonances are identified. Correlations between the impedance function of the body and the subjective tolerance curve to vibration are found and the reasons for the tolerance limits are elucidated. The variability of subjective tolerances due to varying posture, restraining systems, cushions, duration of exposure and vibrations are discussed, and conclusions for the development of protective devices are drawn. The correlation between the steady-state response of the human body system and the effects of impact is discussed. (Author's abstract)

1383
Coermann, R. R.,
E. B. Magid, and K. O. Lange
HUMAN PERFORMANCE UNDER VIBRATIONAL STRESS.—Human Factors, 4 (5): 315-324. Oct. 1962.

Blindfolded subjects, restrained by standard harness, sat on a modified Air Force chair which was programmed to move in random patterns in pitch and roll, the subjects counteracting these motions by using a control stick. The whole device was itself mounted on a mechanical shake table producing vertical sinusoidal motion at frequencies ranging from 2 cycles/second to 20 c./s. and at amplitudes corresponding to about one-third of the subjective tolerance limits. The angular deviations from the upright position were evaluated relative to the disturbing input for both pitch and roll, one minute during the vibration experience and one minute after cessation of the vibration. Some individual subjects were not influenced by the vibration; others showed performance decrements. In the mean, these measures of human performance reflect all mechanical resonances within the body previously established by other methods. The frequencies most affecting performance were found to be between 3 and 12 c./s. Residual effects were detected by the measurements after vibration. (Authors' abstract)

1384
Cohen, A.
DAMAGE RISK CRITERIA FOR NOISE EXPOSURE: ASPECTS OF ACCEPTABILITY AND VALIDITY.—Amer. Indus. Hyg. Assoc. Jour., 24 (3): 227-238. May-June 1963.

Views toward acceptable noise tolerance standards as expressed in a recent poll of persons interested in various aspects of noise and hearing problems were compared with those noted for the same group in a similar poll taken ten years ago. There now exists a greater readiness to establish tentative noise exposure limits and also greater agreement as to their actual specification. An evaluation suggested that most of the proposed criteria would be equally effective, in at least the speech frequencies, in minimizing hearing losses. Estimates of tolerable limits for intermittent exposures to broad-band noise were much more variable than those found for continuous noise. Marked differences in opinion regarding tolerable narrow-band noise exposure limits were also noted. (Author's abstract) (42 references)

1385
THE CONTROL OF NOISE. — (National Physical Laboratory symposium, 12) v+434 p. London: Her Majesty's Stationery Office, 1962.

The proceedings are presented of a conference on noise held at the National Physical Laboratory, June 26-28, 1961. Twenty-five papers are included in this volume, together with edited transcripts of the discussions. Pertinent papers are as follows: Hearing and the ear, by W. Burns; Basic instrumentation for noise measurement, by D. M. A. Mercer; Reduction of noise at the listener's ear, by G. J. Thiessen; Jet engine noise reduction, by T. J. Hargest; Reduction of noise from ground-running aero engines, by W. C. Copeland; Propagation of sound in air, by P. H. Parkin; Subjective scales and meter readings, by D. W. Robinson; Damage-risk criteria and noise-induced hearing loss, by A. Glorig, W. D. Ward and J. Nixon; Techniques of industrial audiometry, by T. S. Littler; Effects of noise on performance and productivity, by A. Carpenter; Noise problems-industry's attitude, by D. Ll. Davies; and Aircraft noise and the community, by F. Ingerslev.

1386
Coussoulakos, A.,
H. Maschas, and G. Yannoulis
[PATHOLOGICAL DISORDERS CAUSED BY VIBRATIONS IN NON-FLYING PERSONNEL OF ATHENS AIRPORT] Troubles pathologiques provoqués par les vibrations concernant le personnel non navigant de l'aérodrome d'Athènes. — Revue de médecine aéronautique (Paris), 1 (4): 18-20. July-Aug. 1962. In French.

Airport noise produces not only stato-acoustic disorders, but also general disorders (fatigue, irritability, weakness). It is also responsible for mental, behavioral, and neurological disorders (insomnia, concentration difficulties, headaches, vertebral pain, depression, visual disorders), cardiovascular disorders (tachycardia, extrasystole, bradycardia), digestive disorders (dyspepsia, nausea, vomiting, duodenal ulcer), and blood disorders (polynucleosis with eosinophilia). Etiopathogenesis is related to the terrain, hearing acuity, the frequency, character, and duration of exposure to noise, former disorders, heredity, and hormonovegetative factors. Special medical and audiometric selection criteria, and personal protective devices (ear plugs, helmets) are recommended for nonflying personnel exposed to noise daily.

1387
Covell, W. P.
CUMULATIVE AUDITORY EFFECTS RESULTING FROM MULTIPLE EXPOSURE TO INTENSE ACOUSTIC STIMULATION. II. HISTOLOGICAL EFFECTS OF INTENSE SOUND ON THE INNER EAR.—Washington Univ. School of Medicine, St. Louis, Mo. (Contract AF 33(616)-3637); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 71786). Technical Documentary Report no. AMRL-TDR-62-99 (II), Jan. 1963. v+12 p.

Histological findings of injuries in the right cochlea of 33 cats subjected to sound exposures are presented. Threshold-shift measurements for these animals were made in part one of this series. Wide-band noise at 115 db. for one-half hour produced mild injuries; for two-hour exposures the injuries were moderate to severe; for eight-hour exposures there were severe injuries. Animals killed two to four hours after exposure showed essentially the same degree of injury with the same two-hour exposure as above. Two hours total exposure at 115 db. divided into 16 doses of 7.5 minutes each, with one hour inter-exposure intervals, resulted in slight to moderate changes. The same total energy in the same number of doses for 7.5 minutes, with an inter-exposure interval of six hours, produced comparatively slight injuries. While considerable variability is evident in different specimens subjected to the same exposure for the same length of time, there persists a general trend for consistency of degree of injury in each group. (From the author's abstract)

1388
Cowden, J. W.,
and M. R. Abell
SOME EFFECTS OF ULTRASONIC RADIATION ON NORMAL TISSUES.—Exper. and Molecular Pathol. 2 (4): 367-383. Aug. 1963.

Lesions were produced in many different rat tissues with ultrasonic irradiation at intensities varying from 1 to 3 watts/sq.cm. for periods of 1 to 15 minutes. The higher the intensity and the longer the duration of treatment, the more severe were the lesions. Focused ultrasound waves of 37.5 total watts of 5 to 15 minutes produced localized areas of necrosis in liver. Other histologic lesions produced by various intensities and durations of treatment included necrosis, inflammation, and edema of skin, subcutaneum, and muscle; degeneration, necrosis and giant cell reaction in testis; necrosis, ulcers, inflammation and hemorrhage in the intestines; and necrosis of bone and hyaline droplet change in renal tubular epithelium. Cavitation, probably due to the accumulation of bubbles of gas, was not observed in livers or other tissues of living animals that were treated. The change was produced in the livers of animals treated in situ after death and in livers removed from the body and treated. (Authors' summary) (45 references)

1389
Cremer, A.
[THE AUDITORY THRESHOLD FOR COMPLEX PERIODIC SIGNALS IN WHITE NOISE] Die Horschwelle komplexer periodischer Signale in weissem Rauschen. —— Archiv fur Ohren- Nasen- und Kehlkopfheilkunde (Berlin), 179 (6): 620-636. 1962. In German.

Auditory thresholds of various pulsed complex signals were measured against a background of white noise to explore the possibility of frequency-dependent delay in the human hearing. The results obtained with signals of modulated amplitude and sinusoidal modulated frequencies confirm the findings of others. With chirp-radar-type modulated signals as a model of the hypothesized delay as a function of frequency it was not possible to obtain a measurable irregularity in the course of auditory thresholds within any range of frequencies, signal duration, or direction. It is concluded that the existence of frequency-dependent delay is highly improbable and is not effective in the hearing process. (Author's summary, modified)

1390
Drogichina, E. A.,
and N. B. Metlina
[ON THE CLINICAL PICTURE OF VIBRATION SICKNESS, CAUSED BY THE ACTION OF GENERAL VIBRATION] K klinike vibratsionnoi bolezni, vyzvannoi vozdeistviem obshchei vibratsii. —— Gigiena truda i professional'nye zabolevaniia (Moskva), 6 (7): 19-22. July 1962. In Russian, with English summary (p. 22)

Vibration sickness provoked by whole-body vibration manifests itself in a specific syndrome: autonomic polyneuritis accompanied by sympathalgia, disturbances of the vibration sense and other sensations received by skin receptors, disturbances of the autonomic nervous system, and changed capillary circulation in the fingers. Diagnostic importance is attached to the alteration of the pulse in the arteria dorsalis pedis, resembling endarteritis. Other symptoms include vestibular pathology with lateral nystagmus, functional disturbances characteristic of neurotic reactions, and hyperthyroidism. Vibration disease is reversible and amenable to treatment.

1391
Duffner, L. R.,
L. H. Hamilton, and M. A. Schmitz
EFFECT OF WHOLE-BODY VERTICAL VIBRATION ON RESPIRATION IN HUMAN SUBJECTS. —— Jour. Applied Physiol., 17 (6): 913-916. Nov. 1962.

The respiration of ten healthy male subjects was studied during 4-minute exposures to vertical whole-body vibration of 0.15 and 0.35 g peak acceleration intensities of frequencies of 2 through 7 cycles/sec. Initial hyperventilation, with a subsequent return toward normal levels, occurred during the period of vibration. The breathing frequency decreased and the end-expiratory position dropped, but the vital capacity was not changed. Vibration-induced hyperventilation was most pronounced at 4-5 cycles/sec. Oxygen consumption was increased during vibration, with a maximum increase observed at the lowest frequencies. All changes were greater at 0.35 g than at 0.15 g acceleration. Except for a decreased alveolar carbon dioxide concentration, respiration during the 4-minute recovery period did not significantly differ from the previbration levels. (Authors' abstract)

1392
Elbowicz-Waniewska, Z.
[INVESTIGATIONS ON THE INFLUENCE OF ACOUSTIC AND ULTRAACOUSTIC FIELDS ON BIOCHEMICAL CHANGES. VIII. EFFECTS ON THE PYRUVATE-LACTATE SYSTEM AND ON LACTIC DEHYDROGENASE ACTIVITY IN THE BLOOD OF GUINEA PIGS] Badania nad wpływem pola akustycznego i ultraakustycznego na procesy biochemiczne. VIII. Wpływ na układ: kwas pirogronowy–kwas mlekowy oraz na aktywność dehydrogenazy kwasu mlekowego we krwi świnek morskich. —— Acta physiologica polonica (Warszawa), 13 (3): 421-429. May-June 1962. In Polish, with English summary (p. 429).

Guinea pigs were exposed to the continued action of sound and ultrasound fields, 100-50,000 c.p.s. in frequency and 2 w/cm.^{2} in intensity, produced by a Hartmann generator. Their blood pyruvate and lactate levels and the lactic dehydrogenase (SLDH) activity were examined. There was a statistically significant rise in the pyruvate level, and contrary to expectations none in the lactate level. These phenomena are discussed in relation to the recorded increase in SLDH activity. (Author's summary, modified)

1393
Fletcher, J. L.
HEARING LOSSES OF PERSONNEL EXPOSED TO IMPULSE AND STEADY STATE NOISE.—Jour. Auditory Research, 3 (2): 83-89. April 1963.

Hearing losses of military personnel exposed to impulse and to steady noise are of the same magnitude and type (perceptive loss with similar slopes from 2000 to 8000 c.p.s.) if exposed from 1 to 79 months. For those who are exposed longer than 80 months, steady-noise exposure appeared to produce somewhat greater hearing losses than impulse noise. Apparent screening effects upon hearing losses were noted in the 1-39 and 40-79 month exposure groups, the latter group containing fewer "noise-susceptible" subjects. (From the author's summary)

1394
Fletcher, J. L.,
and M. Loeb
CHANGES IN THE HEARING OF PERSONNEL EXPOSED TO HIGH INTENSITY CONTINUOUS NOISE. —Army Medical Research Lab., Fort Knox, Ky. (DA Project no. 3A012001A800). Report no. AMRL 566, May 17, 1963. i+9 p.

Pre- and post-exposure thresholds were obtained on 23 persons acutely exposed to a loud continuous noise. Reasonably complete data were secured regarding type and duration of exposure. Correlations between noise exposure and hearing loss were not of statistical significance. The correlation between reference threshold and initial shift was negative and statistically significant, as was the correlation between reference threshold and permanent loss. The correlation between initial shift and permanent loss was positive and significant. (Authors' summary)

1395
Fusco, M.,
O. Elmino, A. Rossi, and A. Silvestroni
[BEHAVIOR OF PERIPHERAL CIRCULATION IN ANIMALS SUBJECTED TO VIBRATIONS] Comportamento del circolo periferico in animali sottoposti a vibrazioni. —— Folia medica (Napoli), 45 (11): 1051-1058. Nov. 1962. In Italian, with English summary (p. 1058).

A study was made of the behavior of the peripheral rheogram and of the cutaneous temperature in two groups of rabbits subjected to vibrations. In the first group an increase in cutaneous temperature by about 3° C., and an increase of the presystolic wave of the rheogram was seen after an hour of vibration. These changes were reversed within 24 hours. In the second series, the animals were subjected to vibration for 15 days, for one hour daily, and readings were taken at 24-hour intervals after the last vibration. No changes were observed in relation to the initial readings. Blood stasis, with vibratory microtrauma, appears to affect the blood vessel wall by conditioning it to a dyskinetic state first, and then to a spasmic state, thereby inducing the complex disease syndrome caused by vibrating instruments.

1396
Gardner, M. B.
BINAURAL DETECTION OF SINGLE-FREQUENCY SIGNALS IN THE PRESENCE OF NOISE. —— Jour. Acoust. Soc. Amer., 34 (12): 1824-1830. Dec. 1962.

The effect of phase and pressure-level differences on the detectability of single-frequency signals in the presence of noise is presented for listening over a binaural transmission system. During the several tests described, the two microphones were supported in free space both in the absence and in the presence of various approximations to an artificial head. The results indicate that over-all detectability is a function of the combined binaural phase relationships of both signal and noise and of the monaural intensity relationship of the two signals at the ear having the higher signal-to-noise ratio. Some indication was found that phase differences may influence detectability to frequencies as high as 2000 c. p. s. Pressure-level differences, on the other hand, decrease in magnitude with decreasing frequency until only a small effect remains at 250 c. p. s. (Author's abstract)

1397
Georgievskii, V. S.,
and E. M. Iuganov.
[EFFECT OF GENERAL VIBRATION ON THE ANIMAL ORGANISM] Vliianie na organizm zhivotnogo obshchei vibratsii—Problemy kosmicheskoi biologii (Moskva), 1: 377-383. 1962. In Russian, with English summary (p. 383).

A total of 61 laboratory experiments were carried out on seven dogs. The animals were subjected to vibrations of 10-70 c.p.s. (amplitude 0.4-2.5 mm.) for 6 minutes. The dogs were able to withstand satisfactorily vibrations directed transversally to the body axis. The vibration approximately doubled the pulse rate and caused a moderate increase in the arterial blood pressure. The article includes three tables showing the effects of vibration on the respiration and pulse rates, and on arterial pressure in dogs.

1398
Gerhardt, H. J.,
and H. Wagner
[THE EFFECT OF MEASURED NOISE STRESS ON THE COCHLEAR MICROPHONICS IN THE GUINEA PIG] Die Wirkung dosierter Geräuschbelastung auf die Mikrofonpotentiale der Meerschweinchenschnecke. —— Archiv für Ohren- Nasen- und Kehlkopfheilkunde (Berlin), 179 (5): 458-472. 1962. In German.

Guinea pigs were exposed to white noise at intensities of 105 decibels, 120 db., and 130 db. The effects were investigated by registering the frequency spectrum of the cochlear microphonic (Mp). The decrease of the Mp under noise stress extended over the entire frequency spectrum. Statistical analysis showed an increasing decline of the

Mp in the direction of the low end of the spectrum. There were no dips similar to the "c^5 dip" in man. Diagrams of the degree of noise damage in relation to noise intensity and duration of exposure reveal that under a critical threshold for noise stress, noise of any duration of exposure does not have an adverse effect on hearing, but above this threshold noise damage increases sharply linear to stress intensity. The decline of the Mp is largest in the beginning of exposure. The stress effects are already marked after 30 minutes. (From the authors' summary)

1399
Gratsianskaia, L. N.,
I. I. Tsirul'nikova, I. M. Velikson, and G. S. Konikova
[CLINICAL STUDY OF VIBRATION SICKNESS IN CONCRETE WORKERS] Klinika vibratsionnoi bolezni betonshchikov.—Gigiena truda i professional'-nye zabolevaniia (Moskva), 6 (1): 34-39. Jan. 1962. In Russian, with English summary (p. 39).

A total of 145 laborers were examined who had been exposed to vibrations of 40 to 50 c.p.s. with an amplitude of 0.003-0.1 mm. for periods ranging from 3 to 10 years. Most subjects showed the angiodystonic syndrome accompanied by diencephalic manifestations such as insomnia and impotence. The internal symptoms, in some cases, consisted of aberrations in the coronary circulation, cardiac dystrophia, and motor and secretory failure of the gastro-intestinal tract. The cholesterine metabolism was abnormal and in some instances the basal metabolism was elevated. The authors include detailed symptomatic and clinical charts.

1400
Grognot, P.,
J. Bourdinaud, and M. A. Gimenez
[PHYSIOPATHOLOGICAL VARIATIONS OF THE ELECTROCARDIOGRAM DURING NOISE] Les variations physio-pathologiques de l'électrocardiogramme pendant le bruit.—Revue de médecine aéronautique (Paris), 2 (7): 227-248. May-June 1963. In French.

Electrocardiograms taken during noise exposure (70-4000 c.p.s. at a sound intensity of approximately 85 decibels) were classified according to mild physiological changes, significant physiopathological changes, and major electric disorders. Mild physiological changes occurred in 95% of the cases, in 60% minimal variations (5-10°) of the cardiac electric axis, in 65% moderate tachycardias, and in 10% slight bradycardias. Significant electric physiopathological variations were found in 5% of the subjects (marked bradyarrhythmias), with 3% having tachycardias, and 30% serious axial electric variations (30-60°). Major disorders observed were concerned with P or T waves, also rarely a rapid QRS complex. In 15% of the subjects, peak repolarization was abnormal and characterized by lengthening of T in D^2, D^3, AVR, AVL waves or in the precordials. One paradoxical result, increase of T amplitude during noise, was noted in all these cases. At the end of noise exposure the abnormalities disappeared, more or less, in about 2-10 minutes. T-wave changes due to noise were almost identical to those found in the same subjects performing a mild Step-Test. Included are 18 representative electrocardiogram tracings. (30 references)

1401
Guérin, H.,
and R. Dutheil
[THE ELECTROMYOGRAM OF THE MUSCLES OF THE FACE IN THE EVALUATION OF TOLERANCE TO NOISE] L'électromyogramme des muscles de la face dans l'appréciation de la tolérance au bruit.—Comptes rendus de la Société de biologie (Paris), 156 (6): 1088-1090. 1962. In French.

Twenty-five adults were exposed for 20 minutes to a noise of 95 decibels at a frequency spectrum of 200 to 10,000 c.p.s. Eight of the subjects showed an intense electromyographic reaction of the facial muscles, and five of these averaged a cardiac frequency of 164 arbitrary units (the others averaged 96 units). Subjective reactions were also rated. It is indicated that an objective evaluation of noise tolerance can be correlated with the electromyogram, the cardiac frequency, and subjective reactions of the exposed subjects.

1402
Havlik, E. J.,
and G. J. Kidera
UNITED AIR LINES HEARING CONSERVATION PROGRAM. — Revue de médecine aéronautique (Paris), 1 (4): 21-25. July-Aug. 1962. In English.

An outline is presented of the basic knowledge on which a hearing conservation program is based, namely: (1) how sound destroys hearing, (2) permissible noise exposure around jets and the type of protection advised, (3) factors considered in evaluating the ear histories and audiograms, and (4) employee education by the doctor upon induction, by pamphlets, educational training films, and by checking for violations by supervisors. Tabulations are included of parameters of tolerance to jet noise, protection required, and maximum exposure time per day at various distances from jet engines.

1403
Hellman, R.,
and J. Zwislocki
EFFECT OF A BACKGROUND NOISE ON THE LOUDNESS FUNCTION AT 1000 CPS [Abstract].—Jour. Acoust. Soc. America, 35 (5): 788. May 1963.

Only a few studies have been concerned with the measurement of the loudness of a 1000-c.p.s. tone in the presence of noise; and there is a considerable discrepancy among the results, especially at low sound intensities. The discrepancy appeared to be due to biases in procedures. In order to determine the form of the masked-loudness function, a series of experiments, which were designed to reduce the biases to a minimum, were performed. It was found that, by decreasing the procedural biases and by obtaining measurements under similar experimental conditions, the average of magnitude estimation and magnitude production can be used to corroborate the results of loudness matching. By combining the loudness-matching field with the one determined by magnitude estimation and magnitude production, the best estimate of the masked-loudness function was obtained. Two loudness curves were constructed, one for a 40-decibel threshold shift and the other for a threshold shift of 60 decibels. The form of these curves was in good agreement with the results of other investigations in which balanced procedures were followed. (From the authors' abstract)

1404
Henkin, R. I.
ANATOMICAL CHANGES IN MIDDLE EAR AND COCHLEA OF THE RAT FOLLOWING STIMULATION WITH HIGH INTENSITY SOUND.—Proc. Soc. Exper. Biology and Med., 113 (3): 513-516. July 1963.

Rats were exposed to sound of 200-220 c.p.s. at an intensity of 130-135 decibels for 2, 12, or 48 hours. A marked increase in secretion of corticosterone was observed after 2 or 48 hours, and a marked decrease after 12 hours. Significant anatomical changes were not observed in the middle ears or cochleas of any of the animals. The data suggest that the changes in secretion rate of corticosterone do not depend on anatomical changes in the rat cochleas. (Author's summary)

1405
Hoffmann, H.,
and H. Kottenhoff
[THE EFFECT OF VIBRATIONS ON PERFORMANCE AND EMOTIONAL BEHAVIOR] Der Einfluss von Vibrationen auf Leistungsfunktionen und emotionales Verhalten. — Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (3): 149-167. 1962. In German.

Twenty students in the age range of 21-37 years were subjected to 30 minutes of vibration at 32 c.p.s. with an amplitude of ± 1 mm. The effects of vibration on performance were investigated before, during, and after the exposure with the following tests: (1) skill tests (mirror drawing, figure completion, and the spiral after-effect); (2) tests of personality or emotionality (subjective emotional rating scale, continuous registration of pulse rate, Brengelmann's questionnaire, and a tachistoscopic reading test); and (3) measurement of psychomotor tone variables (writing pressure). The skill tests showed an inhibition of the retino-cortical excitability (spiral after-effect) by vibration as contrasted to a compensatory or reactive increase in efficiency on the figure-completion and mirror-drawing tests. The pulse rate rose at the beginning of vibration exposure and fell slightly at the end of the exposure period. Negative emotional states expressed on the emotional scale during vibration were reversed only 1 1/2 hours after the end of the exposure in contrast to the quickly reversible changes of the spiral after-effect. Psychomotor tone measurements showed a state of excitation and disinhibition at the beginning of vibration, followed by cortical inhibition after vibration. These data correlated with the findings on the spiral after-effect test. (From the authors' summary)

1406
Hornick, R. J.
EFFECTS OF WHOLE-BODY VIBRATION IN THREE DIRECTIONS UPON HUMAN PERFORMANCE. — Jour. Engineering Psychol., 1 (3): 93-101. July 1962.

The possible influence exerted by whole-body vibration on human performance was investigated experimentally using three planes of vibration at five frequencies and three intensity levels. Body equilibrium was measured before and after each vibration condition. Low-frequency vibration similar to that encountered in vehicles significantly impaired human performance related to control of the vehicle, i.e., compensatory tracking ability, choice reaction time, foot pressure constancy, and peripheral vision may be significantly impaired during and/or following vibration exposure. A certain relationship is indicated between body resonance frequencies for vertical motion (4.5 to 5.5 c.p.s.) and transverse motion (1.5 c.p.s.) and the occurrence of performance decrements as a result of vibration at the same frequencies.

1407
Hornick, R. J.
VIBRATION ISOLATION IN THE HUMAN LEG.—Human Factors, 4 (5): 301-303. Oct. 1962.

In attempting to determine how well the human legs isolate man from vibration imparted to his feet, six subjects stood on a shake-table platform. Each subject experienced vertical vibration of 2 and 5 cycles/second at 1 inch double amplitude ±0.21 g and ±1.3 g peak accelerations. Accelerometers recorded the intensity of vibration at the head level for two minutes of vibration. Results revealed that during the two minutes, the legs gradually lose their ability to isolate, and increasing intensities of motion occur at the head level. (Author's abstract)

1408
Hornick, R. J.
PROBLEMS IN VIBRATION RESEARCH.—Human Factors, 4 (5): 325-330. Oct. 1962.

Man's exposure to low-frequency vibration in vehicles is discussed. Research with humans in vibration experiments has led to a common core of findings, but with some areas of conflict. Discrepancies in results are examined in the light of several methodological problems. These are (1) procedural variations including use of subjects, body restraints, body supports, and constant amplitude vs. constant acceleration experimental designs; (2) terminology, with attention to directions of motion; (3) random vs. sinusoidal motion; (4) single and multiple factors; (5) scaling; and (6) performance evaluation including the matters of equipment setup, vibrating and stable displays, and standardized tasks. (Author's abstract)

1409
Jankowiak, J.,
C. Majewski, and E. Kubiak
EFFECT OF ULTRASOUND ON THE BRAIN OF RABBITS: A HISTOLOGICAL STUDY.—Amer. Jour. Physical Med., 42 (3): 109-112. June 1963.

The brains of two groups of rabbits were irradiated with ultrasound at a frequency of 1 megacycle for five treatments on alternate days with a power of either 2 watts per $cm.^2$ for ten minutes, or 4 watts per $cm.^2$ for five minutes. Macroscopic examination showed only intense passive cerebral hyperemia. Histologic examination revealed small foci of cortical demyelinization on the ninth day following cessation of treatment. Necrotic foci occurred on the twelfth day, and white areas of softening with cavities filled with necrotic masses were found on the fourteenth day, both in the cortex and in the underlying white matter.

1410
Jansen, G.,
and P. Y. Rey
[THE EFFECT OF THE BAND WIDTH OF A NOISE ON THE INTENSITY OF AUTONOMIC REACTIONS] Der Einfluss der Bandbreite eines Gerausches auf die Starke vegetativer Reaktionen. — Internationale Zeitschrift fur angewandte Physiologie (Berlin), 19 (4): 209-217. 1962. In German.

The amplitude of the finger pulse was measured in 17 subjects at rest and during noise of frequency bands of various widths in a total of 122 experiments. The use of a pure tone of 3200 cycles per second of 95 DIN-phon intensity did not result in a clear-cut change of pulse amplitude, while the tertiary-band, octave-band, and broad-band noises (intensity of 95 DIN-phon) resulted in significant lowering of the pulse amplitude. The extent of the fall in amplitude of pulse was dependent on the band width of the noise. Broad-band noise effected a proportionally larger drop in amplitude. (Authors' summary, modified)

1411
Jordan, P.
NOISE-INDUCED DEAFNESS: A PROGRESSIVE OR NON-PROGRESSIVE PROCESS.—Practica oto-rhino-laryngologica (Basel), 24 (3): 185-190. 1962.

In a sample of 324 workers exposed to noisy surroundings where the overall noise level was above 95 decibles, 25 cases of industrial deafness were observed. Most of these were working in their profession for a period of over five years. This fact is contradictory to the generally accepted view that noise-induced deafness is essentially a progressive process and that in given surroundings the time factor in noise exposure is decisive. It appears that the underlying factor determining the extent of auditory damage is a well-limited sensitivity of part of the inner ear to increased sound pressure. Under such conditions, noise exposure leads to auditory damage in the sensitive zone of the inner ear only; further noise exposure of the same type provokes no further hearing loss. It is postulated that in quite a number of noise-induced deafness cases the process is non-progressive. The importance of conducting a reliable survey to determine the incidence of progressivity in noise-induced deafness is stressed.

1412
Jurczak, M.
[EFFECT OF VIBRATION ON THE BODY] Wplyw wibracji na ustroj. — Lekarz wojskowy (Warszawa), 38 (12): 1080-1089. 1962. In Polish, with French summary (p. 1089).

A review is presented of the literature dealing with the physio-pathological effects of vibrations, special consideration being given to vibrations which occur in aviation (helicopters, aircraft, aerodynamic equipment, etc.). The human body reacts to vibration by producing functional and organic changes in the heart, lungs, ears, blood, urine, psychomotor performance, etc. The intensity of these changes depends on the degree of vibration.

1413
Karpman, V. L.,
and G. V. Sadovskaia
[VIBRATORY PROPERTIES OF THE HUMAN BODY] Kolebatel'nye svoistva tela cheloveka.—Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 55 (6): 65-69. June 1963. In Russian, with English summary (p. 69).

This study describes the frequency of oscillations, the coefficient of elastic resilience and the logarithmic decrement of the extinction of oscillation in the human body. New indices suggested to describe the oscillatory properties of the human body are: (1) extinction time of oscillations t_e, (2) restoration time t_r, and (3) the oscillation index σ. It was established that with forces directed along the longitudinal axis there occurred both longitudinal and transverse oscillations which were often asymphasic. (Authors' summary, modified)

1414
Khranova, A.,
and E. Tsankova
[THE SIGNIFICANCE OF VITAMINS B_1 AND C FOR THE PRESERVATION OF NORMAL BLOOD PRESSURE DURING STRESS OF THE HIGHER NERVOUS ACTIVITY IN RATS] Znachenie vitaminov B_1 i C dlia sokhraneniia normal'nogo krovianogo davleniia pri perenapriazhenii vysshei nervnoi deiatel'nosti u krys.—Doklady Bulgarskoi akademii nauk (Sofiia), 15 (6): 661-664. 1962. In Russian, with German summary (p. 664).

A study was made of the effect of auditory stress (electric bell) on the systolic blood pressure in groups of aged rats fed a diet of bread and milk, some with additional NaCl and vitamins. Systolic blood pressure increased in all rats on a diet without vitamin supplement; the highest increase was registered in rats receiving additional sodium chloride. Systolic blood pressure did not increase in rats on a diet with vitamin supplement (B_1 and C). These results point to the importance of vitamins for the preservation of normal blood pressure during stress.

1415
Khursin, M. IU.,
DYNAMICS OF CHANGES IN THE CONTENT AND EXCHANGEABILITY OF NUCLEIC ACIDS AFTER ULTRASOUND IRRADIATION,—U. S. Joint Pub. Research Serv. (Washington), no. 11906 (CSO:6812-N), p. 28-33, Jan. 11, 1962. (Available from Office of Technical Services, U. S. Dept. Commerce)
English translation of: Dynamika zmin vmistu i obminiuvanosti nukleinovykh kyslot pislia oprominennia ul'trazvukovimi khvyliami.—Fiziologichnyi zhurnal (Kyiv), 7 (5): 667-671. Sept.-Oct. 1961. In Ukrainian, with English summary (p. 671).

Testes of albino rats were irradiated with ultrasonic waves (800 kc.p.s.) at intensities of 2.5, 2, and 1 watt/sq. cm. for 10 minutes, and the nucleic acid metabolism was investigated. After exposure to ultrasound at 2 w/cm.^{2} intensity or higher there was a reduction in the nucleic acid content of the testes which persisted for at least two months. Twenty days after exposure to the above intensities the nucleic acid content was reduced also in glands which were not exposed to ultrasound. An intensity of 1 w/cm.^{2} caused a certain reduction in testicular nucleic acid. The uptake of radioactive phosphorus by the nucleic acids in testes declined immediately after irradiation and started to rise again on the third day after exposure. Rapid changes after the exposure but not during the exposure indicate an indirect effect of high-frequency mechanical oscillations on the nucleic acid content. Ultrasound at the intensities used caused lesions of the tissues.

1416
Kryter, K. D.,
and K. S. Pearsons
SOME EFFECTS OF SPECTRAL CONTENT AND DURATION ON PERCEIVED NOISE LEVEL.—Jour. Acoustical Soc. Amer., 35 (6): 866-883. June 1963.

A number of experiments were conducted in which listeners equated a wide variety of sounds with respect to noisiness (equal acceptability) and loudness. The principal findings are as follows: (1) On the basis of data obtained from approximately 250 subjects, new equal-noisiness contours and tables for use in the calculation of perceived noise level were determined. (2) Over a range of durations from 1 1/2 to 12 seconds, sounds were judged equally acceptable when the sound-pressure level was reduced by 4 1/2 decibels for each doubling of duration; variations in rise and decay times from 1/2 to 4 seconds did not significantly influence the judgments. (3) Combining a pure tone of sufficient intensity with a band of filtered white noise caused subjects to judge the sound as noiser than the same band of noise at the same over-all sound-pressure level as the tone-plus-noise; on the other hand, the judged loudness of the band of noise, keeping overall level constant, was not appreciably affected by the addition of the tone. (4) Calculated measures of perceived noise level (PNdB), loudness, and the readings on A, B, C, and "flat" scales on a sound-level meter were determined for a variety of "real" and artificial sounds of equal duration when these sounds were judged to be equally noisy or acceptable. Considering both absolute values and variability in the results, the order of merit, from best to worst, of the various measures for predicting the judgment data was as follows: PNdb, phons Stevens, phons Zwicker, "flat", C, B, and A scale of a sound-level meter. (Authors' abstract)

1417
Lafontaine, E.,
S. Bemelmans, P. Pialoux, and A. Lucas
[PROTECTION OF GROUND PERSONNEL AGAINST SOUND INJURY AND NEW DATA FOR THE PSYCHO-PHYSICAL SELECTION OF PERSONNEL] Protection du personnel au sol contre les traumas sonores et données nouvelles pour la sélection psycho-physique du personnel. — Revue de médecine aéronautique (Paris), 1 (4): 26-27. July-Aug. 1962. In French.

The high noise levels to which ground personnel are exposed daily warrants the use of personal protective devices such as ear plugs and helmets, used singly or together. The importance of periodic audiometric examination and of the education of workers in the use of mixed protection is stressed. The problem of selecting ground personnel has been facilitated by a new audiometric procedure, which is briefly outlined.

1418
Lange, K. O.,
and R. R. Coermann
VISUAL ACUITY UNDER VIBRATION.—Human Factors, 4 (5): 291-300. Oct. 1962.

The influence of vertical sinusoidal vibration on the visual acuity of 12 human subjects, sitting restrained and without padding in an airplane seat mounted on a shake table, was investigated in the frequency range of 1 to 20 cycles/second. A novel visual acuity tester was developed to achieve high accuracy of measurement and to obtain a great many observations in short time periods. The decrement of visual acuity normalized to a shake table acceleration of one g (vector) was determined. Maximum decrements occurred at those frequencies where resonances of the whole body and organ complexes had been determined by other methods. Below 12 c./s. the decrements were due mainly to the physiological stress produced in the body and above 12 c./s. to the image displacement on the retina which had more and more of a blurring effect. Measurements one minute after cessation of vibration indicated residual effects only at frequencies up to 12 c./s., peaks being at the same resonant frequencies. (Authors' abstract)

1419
Langford, T. L.,
and L. A. Jeffress
EFFECT OF NOISE CROSSCORRELATION ON BINAURAL-SIGNAL DETECTION [Abstract].—Jour. Acoust. Soc. America, 35 (5): 803. May 1963.

The cross-correlation of the noise in the critical band was varied by introducing a time delay into the noise channel to one ear. Data were obtained in a two-interval forced-choice experiment, and the data for the time-delayed conditions are presented as masking-level differences (MLD) relative to the undelayed condition (homophasic). There was a rapid release from masking as the cross-correlation was reduced from unity with a less rapid release for the negative values of correlation. The function relating MLD's to values of correlation was cyclic and became damped as the noise delay was increased through several periods of the signal frequency. Data for conditions in which the signal was reversed in phase at one ear are also presented. (From the authors' abstract)

1420
Lazzaroni, A.
[EFFECTS OF VIBRATIONS AND OF LOW FREQUENCIES ON PERSONS LIVING IN THE VICINITY OF AIRPORTS] Effetti delle vibrazioni e delle basse frequenze sulle persone viventi nelle vicinanze degli aereoporti.—Rivista di patologia e clinica (Parma), 18 (12): 1099-1109. Dec. 1962. In Italian, with English summary (p. 1108).

No transitory or permanent damage to the hearing apparatus and central nervous system was found in living near airports as a result of aircraft vibrations and low-frequency noise. Neither was the general state of body health affected. However, transitory, disagreeable abdominal and cephalic sensations were caused by vibrations and low-frequency waves transmitted by the air during flight overhead. Vibrations and low-frequency sounds had a limited effect on speech communication.

1421
Mandel, M. J.,
and R. D. Lowry
ONE-MINUTE TOLERANCE IN MAN TO VERTICAL SINUSOIDAL VIBRATION IN THE SITTING POSITION. —— Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 723101). Technical Documentary Report no. AMRL-TDR-62-121, Oct. 1962. iii+6 p.

One-minute subjective tolerance in man to sinusoidal vertical vibration was determined in the sitting position. In comparing the data to previously published information, it was noted that, although the new levels were higher, the contour of the curve remained unchanged. The reasons for this difference, as well as specific subjective complaints leading to tolerance, are presented and discussed. (Authors' abstract)

1422
Menschow, A. A.
[PROPHYLAXIS OF NOISE AND VIBRATION EFFECT IN THE MODERN AUTOMATIZED INDUSTRY] Zur Frage der Vorbeugung der Lärm- und Vibrationseinwirkung in der modernen automatisierten Produktion.—Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete (Berlin), 9 (3): 186-189. March 1963. In German, with English summary (p. 189).

This is a general review of the effects of noise and vibration on workers in industry gathered in the field and worked out experimentally in the Leningrad and Kiev institutes of industrial hygiene and occupational medicine. One symptom of the detrimental effects of noise is the greater number of autonomic nervous disturbances in the experimental group as compared to controls. Noise and vibration simultaneously applied in an occupational setting result in autonomic neuroses of the lower extremities. Cardiovascular effects listed include a lowered pulse rate and changes in the arterial pressure. Some of the indices taken at the end of the work day revealed increase in oculomotor latency by 0.04 to 0.08 sec. and an increase in errors on discrimination tests which suggest a shift of balance toward inhibition processes in the central nervous system. A two-hour exposure to noise resulted in a rise of the auditory threshold by more than 10 decibels, acceleration of muscle fatigue on ergographic tests, and changes in the simple and differential acoustic-motor reactions. Corresponding changes in the latency of the simple and differential oculomotor response suggest a hypothesis of an imbalance in the regulation of the inhibitory and excitatory processes in the central nervous system. Certain changes were noted also in the latency of the vestibular-motor reflex.

1423
Miller, J. D.,
and C. S. Watson
CUMULATIVE AUDITORY EFFECTS RESULTING FROM MULTIPLE EXPOSURE TO INTENSE ACOUSTIC STIMULATION. I. DEAFENING EFFECTS OF NOISE ON THE CAT.—Indiana Univ. Foundation, Bloomington (Contract AF 33(616)-3844); and Washington Univ., Saint Louis, Mo. (Contract AF 33(616)-3637); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 732101). Technical Documentary Report no. AMRL-TDR-62-99(1), Dec. 1962. ix+75 p.

Aural effects of exposure to intense noise were investigated by measurements of the auditory sensitivity of cats, as determined by their behavior, before and after exposures and by histological examination of their cochleas. Exposures to 115 db. for 1/8 hour or 105 db. for 1/4 hour result in temporary threshold shift (TTS) with the same general features and course of recovery as for man. However, 1/4-hour exposures require 18 db. less sound to produce the same magnitude of shift in the cat. Noise of 115 db. for 1/4, 1/2, 2, or 8 hours without interruption produced permanent threshold shift (PTS) in which magnitude depended on the duration of the exposure, the test-tone frequency, and the susceptibility of the individual cat. When the 2-hour exposure was divided into 16 doses of 1/8 hour each and four different inter-exposure intervals of 0, 1, 6, and 24 hours were used, PTS declined as inter-exposure interval increased. The pattern of injury ratings along the basilar membrane is highly similar to the pattern of the behavioral audiograms, if both are placed on an anatomical-frequency scale. (Authors' abstract) (41 references)

1424
Murphy, D. C.
NOISE SPECIFICATIONS.—Annals Occupational Hyg. (Oxford), 6 (1): 15-25. Jan.-March 1963.

A method is presented for calculating values of sound pressure levels to be incorporated in specifications to manufacturers of equipment which produces noise. Annoyance to the community and damage to hearing of employees are taken as criteria, and tables are given showing specification values obtained after considering the attenuation of noise between source and listener in the case of community annoyance. Hearing conservation criteria are shown for use where damage to employees' hearing is the dominant factor. (Author's abstract)

1425
Nadel, A. B.
VIBRATION.—In: Unusual environments and human behavior, p. 379-394. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

The physiological and structural effects of vibratory forces upon animals and man are reviewed. Tolerance limits for vibration, drawn from many studies, are presented in tabular form. The protection of man against mechanical forces is best accomplished by isolation to reduce transmission of the forces or by an increase of man's mechanical resistance to the forces, although it may be necessary to allow a certain amount of vibration to reach man in order to perform his tasks without decrement. Since tolerance to continuous vibration depends critically on exposure time, such time should be reduced as much as possible to prevent cumulative permanent damage and reduce the possibility of accidents favored by vibration-aggravated fatigue. (25 references)

1426
Nixon, C. W.
INFLUENCE OF SELECTED VIBRATIONS UPON SPEECH. I. RANGE OF 10 CPS TO 50 CPS. — Jour. Auditory Research, 2 (3): 247-266. July 1962.

The speech of sitting and standing talkers under conditions of selected low-frequency vibration was significantly changed from normal speech. Major factors contributing to the altered speech were: (1) a general increase in tension of the body musculature of the speakers in direct response to the transmitted vibratory energy, (2) greater transmission of vibratory energy to the head and body structures (resonances) at certain frequencies, and (3) a bellows-like action of the thorax-abdomen region which interfered with breathing and with the normal modulation of the airstream passing through the mouth. Although speech was clearly altered, the word intelligibility as recorded under vibration was not significantly decreased when perceived in quiet. When heard in the presence of a masking noise, intelligibility deteriorated to a greater extent than could be attributed to the noise alone. The variance in intelligibility of the masked works was clearly related to the frequency of the vibration conditions. (Author's discussion)

1427
Nixon, C. W.,
and H. C. Sommer
INFLUENCE OF SELECTED VIBRATIONS UPON SPEECH (RANGE OF 2 CPS - 20 CPS AND RANDOM).—Aerospace Medical Division. Biophysics Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 723103). Technical Documentary Report no. AMRL-TDR-63-49), June 1963. iii+15 p.

The effects of low-frequency, sinusoidal vibration and random vibration upon speech production of sitting talkers were examined in two series of separate experiments. At the acceleration levels utilized in these experiments: (1) talkers in noise exposed to vibrations of 6 c.p.s. to 10 c.p.s. were less intelligible than nonvibrated talkers in noise; (2) normal speech (non-vibrated) was clearly preferred to the vibrated speech, which was rated as poor speech; (3) word intelligibility was not significantly influenced by random vibration of sitting talkers; (4) there was no difference between duration of normal speech or speech recorded during random vibrations; and (5) no difference between normal and vibrated speech according to subjective evaluation of the speech by the talkers. (Authors' summary)

1428
Orlovskaia, E. P.
[DATA DERIVED FROM AN EXPERIMENTAL STUDY OF THE INFLUENCE EXERTED BY HIGH-FREQUENCY NOISE, NOT EXCEEDING THE MAXIMUM PERMISSIBLE LEVEL, UPON THE BODY OF OPERATORS] Materialy eksperimental'nogo issledovaniia vliianiia vysokochastotnogo shuma, ne prevyshaiushchego predel'no dopustimogo orovnia, na organizm rabotaiushchego. — Gigiena truda i professional'nye zabolevaniia (Moskva), 6 (9): 21-25. Sept. 1962. In Russian, with English summary (p. 25).

The effect of high-frequency noise at 80-db., 70-db., and 65-db. levels (frequency range 1250-2500 c.p.s., peak value at 1600 c.p.s.) on the human body was investigated in an experiment of nearly two hours' duration. A total of 380 tests covering 45 subjects were carried out. Under study were the state of cortical functions, muscular performance, pulse rate, body temperature, and hearing investigated by audiometry. The results show that high-frequency noise at the 80-db. level has adverse effects on the human body, manifested by deterioration of muscular performance, deranged dynamics of basic cortical functions, and shifts of the autonomic nervous functions. In setting hygienic standards for permissible noise levels at the above frequencies, the recommended values should not exceed 65-70 db. The test of muscular performance is sufficiently sensitive for evaluation of the noxious influence of noise.

1429
Parks, D. L.
DEFINING HUMAN REACTION TO WHOLE-BODY VIBRATION.—Human Factors, 4 (5): 305-314. Oct. 1962.

Standardized subjective reaction levels for vibration were derived using 16 physically fit male subjects aged 25 to 40. A controlled environment, hard seat, and lap belt were used to avoid distractions and other interferences from environmental sources, to insure most complete transmission of the same input to all subject and to control possible frequency phase shifts between the subjects and the seat. Four vibration levels were derived: (1) Definitely Perceptible, (2) Mildly Annoying, (3) Extremely Annoying and (4) Alarming. The levels were significantly different. Each level varied in acceleration as a function of frequency. Data describing vibration effects on vision, by level, are presented to indicate the validity of the levels for use as standard vibration conditions in testing human performance. (Author's abstract)

1430
Plomp, R.,
D. W. Gravendeel, and A. M. Mimpen
RELATION OF HEARING LOSS TO NOISE SPECTRUM.—Jour. Acoust. Soc. America, 35 (8): 1234-1240. Aug. 1963.

Because of the many uncontrollable factors, field studies to investigate the relation of hearing loss to noise spectrum are not very suitable. Assuming a close relation between temporary and permanent hearing loss to exist, experiments are done to find the "relative traumatizing power" of different frequencies. Octave bands of noise are used as a stimulus to investigate the threshold shift at one frequency (one-half octave above the center of the noise band), as well as the integrated threshold shift over all frequencies. From these data isotraumatic lines are derived, representing as a function of frequency the sound-pressure levels which give equal threshold shifts. These lines have a minimum at about 3600 c.p.s. with steep slopes below and above this frequency. A review of recent literature shows that generally flatter curves are found. This difference is discussed, but no reasonable explanation can be given. Considerations based on field studies give the impression that a steep isotraumatic line is more probable than a flat one. It is proposed that the isotraumatic line found by the authors, shifted to an appropriate level corresponding with a minimum of 75 decibels, may have some value as a criterion line to conclude whether a noise spectrum will induce hearing losses or not. (Authors' abstract)

1431
Scharf, B.
PARTIAL MASKING OF PURE TONES BY A NARROW BAND OF NOISE [Abstract].—Jour. Acoust. Soc. of Amer., 35 (5): 804. May 1963.

A noise, one critical band wide and centered at 980 c.p.s., was used to mask a tone. The tone, at one or another of five frequencies that ranged in steps of one critical band from 690 to 1355 c.p.s., was presented at 25, 45, 65, and 85 decibels sound pressure level (SPL). As the SPL of the noise decreased, tones lying below the frequency range of the noise increased in loudness from threshold level more slowly than did tones lying above the noise; the low-frequency tones required about twice as much reduction in the SPL of the noise to reach their full unmasked loudness level. Except near threshold, the noise thus reduced the loudness of the low-frequency tones more than that of the high, but the noise raised the threshold for the high-frequency tones more. The reversal of the asymmetry of masking when the masking becomes partial may be accounted for if an unchanging asymmetry in the excitation patterns evoked by the stimuli within the auditory system is assumed. (From the author's abstract)

1432
Shashkov, V. S.,
V. V. Antipov, M. O. Raushenbakh, G. A. Chernov, and V. A. Maslennikova
[EFFECT OF COSMIC FLIGHT ON THE BLOOD SEROTONIN LEVEL IN ANIMALS] Vliianie faktorov kosmicheskogo poleta na uroven' serotonina v krovi zhivotnykh.—Problemy kosmicheskoi biologii (Moskva), 1: 258-264. 1962. In Russian, with English summary (p. 264).

Dogs and mice were used in experiments carried out in Sputniks 4 and 5. Upon completion of the flights it was observed that the serotonin levels were lowered 3.5-10 times in the dogs and 8-10 times in the mice. The drop occurred within 24-48 hours after the flights. Thereafter, the serotonin levels reached normal values. Additional laboratory experiments were performed on mice and guinea pigs. The mice were subjected to vibrations of 35-70 c.p.s. for 15 min.; the guinea pigs, to accelerations of 10 g and vibrations of 70 c.p.s. and 0.4 mm. amplitude for 15 min. Immediately after the tests, the serotonin levels of the test animals dropped 4.3-10 times, but reached control values after 48 hours. (31 references)

1433
Shibata, H.
STUDIES ON THE EFFECTS OF THE MECHANICAL VIBRATION UPON THE LIVING BODY. XI. EFFECT OF DIFFERENCE IN CASE OF HORIZONTAL VIBRATION FROM THE VIEW OF ENERGY METABOLISM.—Shikoku acta medica (Tokushima), 19 (1): 69-76. Feb. 1963. In Japanese, with English summary (p. 69).

Two subjects rested on a bed and then sat in a chair for 20 minutes. They were then exposed to longitudinal and transverse mechanical vibrations from an apparatus with an amplitude of 10 mm. and a frequency of 400-800 cycles per minute. Longitudinal vibration had a greater effect on energy metabolism (oxygen consumption) than transverse vibration. The greater the vibration frequency, the greater the effect on metabolism. Included are representative tables and graphs. (Author's summary, modified)

1434
Shibata, H.
STUDIES ON THE EFFECTS OF THE MECHANICAL VIBRATION UPON THE LIVING BODY. XII. EFFECTS OF CIRCULATORY SYSTEM UPON THE HUMAN BODY.—Shikoku acta medica (Tokushima), 19 (1): 77-82. Feb. 1963. In Japanese, with English summary (p. 77).

The heart rate and maximum and minimum blood pressures were recorded by the electrocardiogram and Riva-Rocci sphygmomanometer in three seated persons exposed to vibrations with an amplitude of 0.5-1.0 mm. and a frequency of 500, 1000, and 1500 cycles per minute. Vibration shortened the interval between heart beats. The greater the frequency and amplitude of vibration, the greater the change in ratio. Blood pressure, irrespective of minimum or maximum, increased in accordance to the amplitude and frequency of vibration. Included are representative tables and graphs. (Author's summary, modified)

1435
Shpil'berg, P. I.
[ELECTROENCEPHALOGRAPHIC STUDIES OF VIBRATION SICKNESS CAUSED BY THE ACTION OF GENERAL VIBRATION] Elektroentsefalograficheskie issledovaniia pri vibratsionnoi bolezni, obuslovlennoi vozdeistviem obshchei vibratsii. — Gigiena truda i professional'nye zabolevaniia (Moskva), 6 (4): 14-22. April 1962. In Russian, with English summary (p. 22)

Electroencephalographic investigation of 105 cases of vibration sickness showed diffuse or bilateral encephalographic changes in the majority of the cases and localized changes in a few cases. The EEG were characterized by synchronized alpha and theta waves, rarely delta waves. Synchronized waves in form of spindles appeared at rest or upon provocation, e.g., hyperventilation. Sometimes the waves were continuous. External stimuli resulted in prolonged latency of the response. Alpha waves were obtained chiefly from the occipital area, while theta waves were derived from the sincipito-temporal areas or occurred diffusely. In some patients the EEG shifts were reversible while in others they persisted even after removal of the vibration hazard. (Author's summary, modified)

1436
Snyder, F. W.
PRELIMINARY REPORT OF A RESEARCH PROGRAM ON THE EFFECTS OF LOW-FREQUENCY VIBRATION ON HUMAN PERFORMANCE. — Perceptual and Motor Skills, 14 (1): 62. Feb. 1962.

This is a brief description of an extended program of research on the effects of low-frequency, high-amplitude sinusoidal vibration on perceptual and motor task performance undertaken by the

Boeing Company. The work phases are aimed to: (1) determine relationship between estimated severity of vibration and over-all performance decrement on a complex perceptual-motor task, (2) determine the effects of vibration on perception of visual and auditory displays, and (3) translate the findings in a format usable to design and human-factors engineers. Vibration facilities include temperature and lighting control, isolation of the subject, a communication system, one-way observation windows, and a vibration unit with vertical motion to 20 in., double amplitude from 0 to 2.4 c.p.s. and acceleration of 3 g from 2.4 to 30 c.p.s.

1437
Starr, A.,
and R. B. Livingston
LONG-LASTING NERVOUS SYSTEM RESPONSES TO PROLONGED SOUND STIMULATION IN WAKING CATS.—Journal of Neurophysiology, 26 (3): 416-431. May 1963.

Conscious cats with multiple implanted electrodes were exposed to prolonged, steady white noise. Summated electrical activity was recorded before, during, and after exposure to the unchanging stimulation. Responses to sustained sound stimulation were limited to the classical auditory pathway—sustained cortical responses were localized to a small region near the upper end of the posterior ectosylvian sulcus. Responses from lower auditory stations including the round window did not rise to maximum amplitude until after about an hour or longer of steady sound exposure. They were held in check by middle-ear muscle and central neural mechanisms. Maximum sustained response amplitudes decreased as one proceeds from the round window to cortex. Following discontinuation of prolonged, loud sound stimulation, every subcortical part of the central auditory pathway exhibited a profound, prolonged, reversible reduction in activity to below the level prior to sound stimulation. All these phenomena of noncorrespondence between the sound stimulus and the response of the auditory pathway are interpreted as being due to active mechanisms resisting change. These electrophysiological phenomena may be related to perceptual effects and aftereffects associated with long-continuing sensory stimulation. Analysis of the effects of prolonged stimulation may provide experimental access to some of the mechanisms underlying memory, learning, and other phenomena relating to sensory experience. (Authors' summary, modified) (25 references)

1438
Straneo, G.,
P. Seghizzi, and M. Majeron
[THE EFFECT OF NOISE ON THE VASCULAR SYSTEM. III. RHEOGRAPHIC (PERIPHERAL AND CRANIAL) AND RETINOGRAPHIC STUDY] L'azione del rumore sul sistema vascolare. III. Studio reografico (periferico e cranico) e retinografico.—Folia medica (Napoli), 45 (11): 1009-1015. Nov. 1962. In Italian, with English summary (p. 1015).

Retinographic and rheographic tracings were made of the retinal, cerebral, and deep limb blood vessel reactivity under stimulation by industrial noise. Whereas retinal vessels showed no significant changes under noise conditions, endocranial vessels displayed a reduction in tone. This finding is diametrically opposed to that observed at the level of the deep arteriole of the arm. Included are representative rheographic tracings.

1439
Svadkovs'ka, N. F.
[EFFECT OF ULTRASONIC VIBRATIONS ON THE BODY TEMPERATURE OF ALBINO RATS] Vplyv ul'trazvukovykh kolyvan' na temperaturu tila bilykh shchuriv.—Fiziologichnyi zhurnal (Kyiv), 9 (3): 395-396. 1963. In Ukrainian.

Rats irradiated with ultrasound (0.14-2 w/cm.^{2}) did not show any significant change in body temperature after the first exposure; however, their temperature was somewhat higher after repeated (4 to 6 times) irradiations.

1440
Tigyi, J.
THE EFFECT OF ULTRASOUND TREATMENT ON THE Na-^{24}Na, K-^{42}K AND P-^{32}P EXCHANGE IN MUSCLE.—Acta physiologica Academiae scientiarum hungaricae (Budapest), 21 (3-4): 259-266. 1962. In English.

Sodium (Na), potassium (K), and phosphorus (P) activity in frog muscle was studied by means of an ultrasonic generator with a frequency of 10^6 c.p.s. and an intensity of 1-2 watts/square centimeter. Muscles (parallel sartorius) were placed in Ringer solution with added radioactive isotopes Na^{24}, K^{42}, and P^{32}. Within 20 minutes, the specific activity of Na^{24} in the muscle increased by 25-45%, in three hours muscle K^{42} activity increased by 20-35%, and in two hours muscle P^{32} specific activity increased by 100%. The increase in the rate of K-^{42}K exchange in response to ultrasonic treatment was at least one order of magnitude smaller than that of Na-^{24}Na and P-^{32}P, respectively. This selective action of ultrasound was correlated with the bound state of potassium. (Author's summary, modified)

1441
Trense, E.
[EXPERIENCES WITH THE FLICKER FUSION FREQUENCY TEST OF WORKERS IN NOISY OCCUPATIONS] Erfahrungen mit dem Flimmertest bei Lärmarbeitern. —Internationales Archiv für Gewerbepathologie und Gewerbehygiene (Berlin), 19 (2): 226-246. April 16, 1962. In German.

Flicker fusion frequency was measured under several experimental conditions in 319 subjects from various occupations which expose them to noise in the range of 105-120 DIN phon. It was possible to show in 12,360 separate tests that exposure to noise markedly lowers the flicker fusion frequency if the subjects are not wearing protective devices or receiving stimulants. Wearing of noise-prophylactic devices checked the fall in flicker fusion frequency to a highly significant degree.

1442
Tseitina, A. Ia.,
S. A. Lapina, and A. A. Arkad'evskii
[EFFECTS OF NOISE ON VITAMIN C METABOLISM IN EXPERIMENTAL ANIMALS] Vliianie shuma na C-vitaminnyi obmen u eksperimental'nykh

zhivotnykh.—Voprosy pitaniia (Moskva), 22 (1): 78-83. Jan.-Feb. 1963. In Russian, English summary (p. 83).

Guinea pigs receiving a daily dosage of 25 mg. of vitamin C were exposed to noise of an intensity of 110 db. and a frequency of 1250 c.p.s. The vitamin C content in the urine and in the adrenals was reduced, even when the daily dosage was increased to 100 mg. A reduction in urine volume was also noted during 4-hour exposures to noise.

1443
White, G. H.,
K. O. Lange, and R. R. Coermann
THE EFFECTS OF SIMULATED BUFFETING ON THE INTERNAL PRESSURE OF MAN.—Human Factors, 4 (5): 275-290. Oct. 1962.

The effects of mechanically induced vibration upon the human abdomen were determined by measuring the pressure in the rectal end of the colon sigmoideum. A technique was developed for transmitting the internal pressure to external recorders, and the amplitudes of the colon pressure fluctuations were determined, when eight human subjects and one Rhesus monkey were subjected to vertical sinusoidal vibration at vector accelerations of less than one g, in the frequency range of 1 through 20 cycles/second. The pressure fluctuations were found to vary with frequency, showing maximum mean "peak to peak" pressure, per one g acceleration, of 57 mm. Hg at 4.5 c./s. and 4 c./s., sitting erect and sitting relaxed; and 30 mm. Hg at 7 c./s. in the semisupine posture of human subjects. These resonances confirm the results of related prior studies of the human body as a mechanical system. (Authors' abstract)

1444
Yokoyama, T.
STUDIES ON OCCUPATIONAL DEAFNESS. I. SUBJECTIVE SYMPTOMS CONCERNING AUDITORY APPARATUS AND VARIOUS FATIGUE.—Jour. Oto-Rhino-Laryngological Soc. Japan (Tokyo), 65 (12): 1324-1342. Dec. 1962. In Japanese, with English summary (p. 1324).

The percentage of mental and somatic disorders decreased with age in 237 workers in a noisy factory. The tendency towards neurosensory disturbances increased with the increase in age. Noise-exposed workers (17%) complained of sleep disorders, but the feeling of being hard-of-hearing, and tinnitus were the conditions most frequently found. Emotional disorders such as anxiety, irritability, etc., and headache were less frequently reported. Subjective symptoms relative to the auditory apparatus were found, such as hearing disorders (56%), tinnitus (36%), and vertigo (13%). Workers were first conscious of hearing disorders, tinnitus, or vertigo 3-5 years after employment in a noisy environment. So-called paracusis Willisiana was observed in 13 persons. (Author's summary, modified) (74 references)

1445
Young, W. A.,
D. B. Shaw, L. J. Buckles, J. S. Outerbridge, C. E. Reeves, and J. C. Truman
EFFECT OF CO_2 ON HYPERVENTILATION PRODUCED BY VIBRATION. —— Jour. Applied Physiol., 18 (2): 349-352. March 1963.

Twenty-five normal subjects were exposed to low-frequency high-amplitude passive vibratory movements of the body. Hyperventilation and hypocapnia resulted in most cases. Restoration of the alveolar carbon dioxide tension (P_{CO_2}) to its resting value by the addition of CO_2 to the inspired air while vibration continued gave rise to no further increase in ventilation. It is concluded that the hyperventilation produced by vibration is not moderated by the resulting fall in arterial P_{CO_2}. Thus, observed differences between the ventilatory response of different individuals to vibration are unlikely to be due to differences in sensitivity to CO_2. (From the authors' abstract)

h. Physical Work

1446
Andersen, K. L.,
S. Strømme, and R. W. Elsner
METABOLIC AND THERMAL RESPONSES TO MUSCULAR EXERTION IN THE COLD. —— Inst. of Work Physiology, Oslo, Norway (Grant no. AF-EOARDC-61-32); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8240-19). Technical Documentary Report no. AAL-TDR-61-52, June 1962. iv+26 p.

The metabolic and thermal responses to muscular exertion in a cold environment were studied in outdoor and indoor workers. The metabolic rate in all subjects during exercise was higher in the cold environment than in the warm environment at low levels of work; at higher workloads it was the same. In the cold environment there was a tendency towards lower oxygen uptake of the outdoor workers than of the indoor workers at low levels of work; at high levels it was essentially the same. Differences in skin temperature and onset of rewarming indicate an adaptability to cold of the vasomotor control mechanisms of the peripheral circulation. It is suggested that habituation to cold leads to a lower set point of the thermosensitive cells of the thermoregulatory center, so that vasodilation impulses are discharged at a lower temperature. (Authors' abstract) (28 references)

1447
Andersen, K. L.,
J. S. Hart, H. T. Hammel, and H. B. Sabean
METABOLIC AND THERMAL RESPONSE OF ESKIMOS DURING MUSCULAR EXERTION IN THE COLD. —— Jour. Applied Physiol., 18 (3): 613-618. May 1963.

Performing muscular work in cold surroundings results in a greater energy requirement than that in a neutral environment at low levels of work, but is the same as that in a neutral environment at higher levels of work when rectal temperature is increased by the work. No higher heat production could be demonstrated in Eskimos than in Caucasians. It was found that rectal temperature increases during muscular work up to a certain level, this being almost constant over a wide range of environmental temperatures if the rate of work is constant. But when work rate becomes sufficiently low, the heat production is too small to compensate for the increased heat loss in the cold, so that the rectal temperature falls. A quicker onset of the rewarming of the previously cooled skin of the hands was found in Eskimos than in Caucasians as a result of exercise in the cold. This suggests a different vasomotor control of the blood supply to the skin. (Authors' abstract)

1448
Andersen, K. L.,
and J. S. Hart
AEROBIC WORKING CAPACITY OF ESKIMOS.—Jour. Applied Physiol., 18 (4): 764-768. July 1963.

The aerobic working capacity was measured in eight young Eskimos. Their maximal oxygen uptake averaged 2.6 liter/minute. This is considerably lower than that found in young Caucasian men. The heart rate-oxygen uptake relationship also indicates a lower physiological capacity of the Eskimos. Expressing maximal oxygen uptake on a body weight basis brings about substantial agreement with results of experiments on sedentary-living Scandinavian students. The heart rate taken at the end of the maximal work averaged 173/minute for the Eskimos which is about 10% lower than found in Caucasian men, indicating that the work test (bicycling) did not activate the circulatory system of the Eskimos maximally. By assuming a linear correlation between heart rate and oxygen consumption up to its maximal value, the maximal oxygen uptake would have to be 20% greater to give a maximal heart rate similar to that observed in Caucasian men. The pulmonary ventilation efficiency during exercise was found to be lower in Eskimos than in Caucasian men. (Authors' abstract)

1449
Åstrand, P.-O.,
I. Hallbäck, R. Hedman, and B. Saltin
BLOOD LACTATES AFTER PROLONGED SEVERE EXERCISE.—Jour. Applied Physiol., 18 (3): 619-622. May 1963.

Blood was drawn from cross-country skiers at one to three minutes after the finish in competitions on distances from 10 to 85 kilometers and the blood lactate determined. Despite a maximal effort of the skiers, accentuated at the end of the race, there was a successive decrease in the blood lactate concentration with work time. After a 10-kilometer race, work time 35-36 minutes, the average was 139 mg./100 ml. of blood; after a 30-kilometer race, with a time of 1 hour 50 minutes to 1 hour 56 minutes, the mean value was 68 mg./100 ml. of blood; and after a 50-kilometer race, work time 3 hours 6 minutes to 3 hours 18 minutes, 39 mg./100 ml. A lactate concentration exceeding 100 mg./100 ml. is a common finding after maximal muscular exercise involving large muscles. Data are presented on the oxygen uptake attained during skiing at actual racing speed (average V_{O_2} = 4.45 liters/minute). (From the authors' abstract)

1450
Baumann, P.,
J. Escher, and R. Richterich
[THE BEHAVIOR OF SERUM ENZYMES DURING PERFORMANCE OF SPORTS] Das Verhalten von Serum-Enzymen bei sportlichen Leistungen.—Schweizerische Zeitschrift für Sportmedizin (Genève), 10 (2): 33-51. 1962. In German, with English summary (p. 50-51).

A study was made of the effects of muscular exertion and muscular trauma on enzymatic activity in the serum and its dependent relation to the state of training of the subjects. In subjects that had done intense physical labor during two days there was found a significant rise in adolase, lactic dehydrogenase, and creatine-kinase. A two-hour experimental run caused, in the highly trained, a threefold increase in creatine-kinase, and none at all in lactic dehydrogenase; in contrast, the markedly increased initial values were largely normalized during the run. A patient with severe muscular sprain showed very high values, and patients with large smooth muscle cuts showed mostly normal values. Light boxing for half an hour evidently represents a sub-threshold trauma. The causes of post-exertion muscular stiffness are discussed. Sub-lightmicroscopic organic lesions and/or biochemical lesions are considered. (Authors' summary)

1451
Belding, H. S.
HAZARDS TO HEALTH: WORK IN HOT WEATHER.—New England Jour. Med., 226 (20): 1052-1054. May 17, 1962.

Health hazards from work in the heat at industrial jobs and during training in military service are discussed. The evaluation of conditions by the Wet-Bulb-Globe Temperature index as practiced at the Parris Island Marine Training Center, and the program for preventing heat collapse are briefly described. Acclimatization by work, various metabolic factors concerning heat control, and the risk of heat injury due to age and job conditions are discussed.

1452
Bickelmann, A. G.
E. J. Lippschutz, and L. Weinstein
THE RESPONSE OF THE NORMAL AND ABNORMAL HEART TO EXERCISE: A FUNCTIONAL EVALUATION.—Circulation, 28 (2): 238-250. Aug. 1963.

With the use of dye-dilution methods for the determination of cardiac output in conjunction with multiple, graded-exercise loads, normal and abnormal human subjects were studied. In normal individuals, the response of the cardiac output and stroke volume to the stress of graded exercise may be utilized to assess the functional capacity of the heart; increments of cardiac output under the stress of exercise are governed by stroke volume as well as heart rate. (From the authors' summary and conclusions)

1453
Billewicz-Stankiewicz, J.,
and W. Tyburczyk
[THE CHANGES IN THE ADRENALINE OXYDASES OF THE BLOOD PLASMA DURING PHYSICAL WORK] Über die Veränderungen der Adrenalin-Oxydasen des Blutplasmas während physischer Arbeit—Internationale Zeitschrift für angewandte Physiologie (Berlin), 20 (1): 62-74. 1963. In German.

Twenty-eight rats were subjected to forced swimming in water at 37° C. for one hour, whereby they carried a weight of 30 grams for 15 minutes (moderate stress) or throughout the whole hour (greater stress). Plasma adrenaline oxidase (AdO) activity was determined before and after the physical work. The average enzyme activity did not change significantly over an hour's interval in resting controls; it decreased statistically highly significantly under moderate stress, and increased under greater stress. Sympatholytic substances (atropine, dihydroergotoxin) and reserpine did not affect the increase in AdO activity after physical stress. After ten-day administration of Atophan the increase in enzyme activity after physical work did not take place. Serum protein concentration did not vary significantly before and after the physical exercise. The increased activity of the adrenaline oxidases after physical stress is assumed to be caused by mobilization of enzyme-rich blood depots in the liver.

1454
Binkhorst, R. A.,
and P. van Leeuwen
A RAPID METHOD FOR THE DETERMINATION OF AEROBIC CAPACITY.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (6): 459-467. 1963. In English.

Comparative experiments were made on a bicycle-ergometer for the determination of the aerobic capacity with steady-state loads and with continuously increasing loads. It appeared possible to measure the actual aerobic capacity in a single session with the continuously increasing load. (Authors' summary)

1455
Biró, L.,
and Z. Botár
[ON THE BEHAVIOR OF INTRAOCULAR TENSION IN VARIOUS SPORT ACTIVITIES] Über das Verhalten des Augendrucks bei verschiedenen Sportleistungen. —Klinische Monatsblätter für Augenheilkunde (Stuttgart), 140 (1): 29-30. Feb. 1962. In German, with English summary (p. 29-30).

The authors have investigated intraocular tension and blood pressure before and after 100-meter and 1000-meter races as well as before, during, and after the Valsalva experiment. During pressing (Valsalva experiment) intraocular tension increased by 5.4 mm. Hg on the average, while after a 100-meter race it decreased by 0.3 mm. Hg, and after a 1000-meter race by an average of 3.6 mm. Hg; i.e., the static sport activities which inhibit the circulatory system will bring about an elevation of intraocular tension while rhythmic muscular activities promoting circulation will lower the intraocular tension. A conspicuous parallelism could be observed between the intraocular tension and the simultaneously recorded blood pressure values in such a way that at the static muscle functions which are associated with pressing, the diastolic pressure and, as a consequence, also the intraocular tension had increased. On the other hand, the diastolic pressure and thus also the intraocular tension were found decreased in sprint which does not impede the circulatory system. (Authors' summary)

1456
Borg, G.,
and H. Dahlström
A PILOT STUDY OF PERCEIVED EXERTION AND PHYSICAL WORKING CAPACITY. —Acta Societatis medicorum upsaliensis (Uppsala), 67 (1-2): 21-27. 1962. In English.

A pilot study was conducted with two groups to explore how the subjective perception of exertion during a physical work test and the physical working-capacity correlate with an independent criterion. The test was conducted on a bicycle ergometer; the individual's working capacity was determined from pulse rates and from the perceived exertion according to a rating scale. The results showed a co-variation between the subjective ratings of exertion and the pulse rate, and further a correlation of these two variables and an independent criterion. These findings suggest that the validity of the physical work test may be increased by using a supplemental simple rating scale.

1457
Caldwell, L. S.
THE LOAD-ENDURANCE RELATIONSHIP FOR A STATIC MANUAL RESPONSE.—Army Medical Research Lab., Fort Knox, Ky. (DA Project no. 3A012001A800). Report no. 573, May 21, 1963. ii+14 p.

An essentially linear relationship was obtained between the relative load (the percentage-of-maximum strength) and the endurance of the manual response within the range of loads employed. As the load was increased from 50% to 80% of maximum strength, the mean endurance of manual pull decreased from 63.3 sec. to 21.4 sec. A comparison of endurance scores for two arm positions yielding different response strengths revealed little difference in performance despite the fact that the mean force to be maintained was 41% greater at one arm position than at the other. (Author's abstract)

1458
Caldwell, L. S.
RELATIVE MUSCLE LOADING AND ENDURANCE.—Army Medical Research Lab., Fort Knox, Ky. (Project no. 3A012001A800). Report no. 586, July 29, 1963. i+11 p.

The maximum strength of manual pull was determined for both male and female subjects. Each subject was then required to maintain control forces at several proportions of his maximum strength. As the relative load was increased from 25% to 100% of maximum strength the response endurance decreased at a diminishing rate from 252 seconds to 2 seconds. No statistically significant difference in endurance was obtained between sexes, despite the fact that the mean absolute loads sustained by the males were approximately twice those for the females. The subjects differed significantly in endurance, but this was not attributable to differences in strength, or the actual loads maintained. Thus, when individual differences in strength were removed through use of the relative loading technique, there was no statistically significant relationship remaining between the actual force sustained and the endurance of a static response. (Author's abstract)

1459
Carlson, L. A.,
L.-G. Ekelund, and L. Orö
STUDIES ON BLOOD LIPIDS DURING EXERCISE. IV. ARTERIAL CONCENTRATION OF PLASMA FREE FATTY ACIDS AND GLYCEROL DURING AND AFTER PROLONGED EXERCISE IN NORMAL MEN.— Jour. Lab. and Clinical Med., 61 (5): 724-729. May 1963.

The arterial concentrations of plasma free fatty acids and plasma glycerol were determined during exercise periods of 60 minutes at a constant work load in 5 normal men. The concentration of free fatty acids decreased during the first 20 minutes, but thereafter there was no significant difference. After work ended, a temporary increase in free fatty acids occurred. The glycerol concentration in plasma increased steadily with a fourfold rise occurring after 60 minutes of exercise, but the concentration declined rapidly after exercise finished. The possibility is discussed that the increased glycerol level in blood during exercise reflects an increased lipolysis of adipose tissue glycerides. The increased flux of free fatty acids through plasma during exercise might thus be affected by an enhancement of the lipolytic process in the adipose tissue. (Authors' abstract, modified)

1460
Carlsten, A.,
B. Hallgren, R. Jagenburg, A. Svanborg, and L. Werkö
ARTERIAL CONCENTRATIONS OF FREE FATTY ACIDS AND FREE AMINO ACIDS IN HEALTHY HUMAN INDIVIDUALS AT REST AND AT DIFFERENT WORK LOADS. — Scandinavian Jour. Clinical and Lab. Invest. (Oslo), 14 (2): 185-191. 1962.

The influence of physical work on the arterial plasma levels of free amino acids and free fatty acids was studied in 13 healthy individuals in a postabsorptive state. During work the total amino nitrogen level increased. Among the individual amino acids alanine increased markedly. After a slight fall in the plasma free fatty acid level during the first minutes of exercise, the free fatty acids increased to the pre-exercise level after about 15 minutes of exercise. The percentage of stearic acid in the free fatty acid fraction decreased markedly during work. The significance of these findings for muscle metabolism during work is discussed. (Authors' summary)

1461
Challey-Bert, P.,
F. Plas, G. Pallardy, P. Bugard, J. Babinet, E. Lopez, M.-T. Puissegur, and J. Gabriel
[PROTEIN METABOLISM DURING PROLONGED EFFORT] Le metabolisme protéidique au cours de l'effort prolongé.—Presse médicale (Paris), 70 (15): 705-707. March 24, 1962. In French.

An increase was found in the protein metabolism of three subjects undergoing prolonged muscular exercise for 18-24 hours, as evidenced by the increase in blood proteins, urea, and uric acid. The urinary elimination of nitrogen products confirmed the increase in protein catabolism during muscular work. The protein ration furnished an insignificant caloric supply, about 1/8th of the total ration. This protein supply appeared to be indispensable for the reconstitution of muscle proteins which was made possible during prolonged work by an increase of adrenal anabolizing hormones. During prolonged effort, the nitrogen requirement of the body is increased, leading to a state of protein deficiency, in spite of a notable protein supply, and a negative state of sodium balance in which the quantity eliminated is always higher than that ingested. This study indicates that physical activity creates a protein requirement greater than previously estimated.

1462
Coffman, J. D.
BLOOD FLOW AND OXYGEN DEBT REPAYMENT IN EXERCISING SKELETAL MUSCLE.—Amer. Jour. Physiol., 205 (2): 365-369. Aug. 1963

Blood flow and oxygen consumption of the hind limb of the dog were determined before and following three levels of exercise. Flow debts were underpaid or barely repaid. Oxygen debts were entirely or partially repaid depending upon the level of muscle performance. In resting muscle and during light exercise, both increased blood flow and oxygen extraction were involved in repayment of the oxygen debts while an increased blood flow was most important during medium and strong exercise. Since oxygen debts were often not repaid during strong exercise in the presence of a decreased arteriovenous oxygen difference (and often an oxygen utilization below control levels), oxygen extraction was the limiting factor. Significant excess repayments of oxygen debts occurred in resting muscle. (Author's abstract, modified)

1463
Craig, F. N.,
and E. G. Cummings
SLOWING OF THE HEART AT THE BEGINNING OF EXERCISE. — Jour. Applied Physiol., 18 (2): 353-356. March 1963.

At 18° C. the heart began to beat faster at the beginning of treadmill exercise. In the first 10 beats, the average increase above the previous standing rate amounted to 12 beats/min. in walking and 28 beats/min. in running. At 38° C. or when atropine was injected, the standing rate before exercise was rapid; in the immediate response to exercise, the rate increased less than at 18° C. without atropine, remained the same as in standing, or decreased temporarily below the standing rate by as much as 40 beats/min. These early responses were attributed to changes in vagal inhibition. After the start of the run there was a secondary increase between the 25th and 60th second that averaged 22 beats/min. at the peak of the response to atropine. This secondary increase was attributed to accelerator activity. (Authors' abstract)

1464
Critz, J. B.,
and A. W. Merrick
SERUM GLUTAMIC-OXALACETIC TRANSAMINASE LEVELS AFTER EXERCISE IN MEN. — Proc. Soc. Exper. Biol. and Med., 109 (3): 608-610. March 1962.

Serum glutamic-oxalacetic transaminase (SGOT) was determined in trained and untrained men after exposure to exercise through the Harvard

Step Test or timed track events. The untrained human subjects exhibited a significant decrease in SGOT. In athletes, competing in timed track events, there was also depletion in serum transaminase titer. However, in well-trained athletes there was no alteration in serum transaminase level following the same exercise as that of the untrained men. The role of the adrenal cortex and its possible interrelationship with transaminase movements, as influenced by exercise and stress, is discussed. (Authors' summary) (26 references)

1465
Cummings, E. G.
BREATH HOLDING AT BEGINNING OF EXERCISE. — Jour. Applied Physiol., 17 (2): 221-224. March 1962.

Men stood astride a moving treadmill belt and at a verbal signal held their breath, jumped on the treadmill belt, and walked or ran at a series of speeds up to 9 m.p.h. until the breaking point was reached. Breath-holding time decreased sharply with increasing exercise rates, but began to level off at approximately 30 seconds between 6 and 9 m.p.h. Breaking-point alveolar oxygen tension decreased and carbon dioxide tension increased with increasing treadmill speeds. When these two factors were applied in the Otis, Fenn, and Rahn ventilation equation to describe ventilation at the breaking point, the ventilation ratio increased, and it was observed that the men withstood a stronger stimulus to breathe as the work rate increased, even though the breath-holding time remained fairly constant at higher work levels. Apparently at the beginning of work the stimulus to breathe is the combination of a relatively weak neurogenic stimulus and an accumulating chemical stimulus. It is postulated that the constancy of beginning breath-holding times at high work rates may reflect a transport time for the chemical stimulus to reach the receptor area from working muscles via the circulation. (Author's abstract)

1466
Cummings, E. G.,
and F. N. Craig
SLOWING OF THE HEART AT THE BEGINNING OF EXERCISE [Abstract]. — Physiologist, 5 (3): 123. Aug. 1962.

In a room at 18° C. the heart began to beat faster at the beginning of exercise on a treadmill. In the first minute the increase above the previous standing rate amounted to 20 or 30 beats per minute for walking at 3 miles per hour and 90 or 100 beats per minute for running at 9 miles per hour. When the standing rate before exercise was elevated by increasing the room temperature to 38° C. or by injecting atropine, or both, the immediate response to exercise was a retardation of the increase, a continuation of the standing rate, or a temporary depression of the rate below the standing rate by as much as 40 beats per minute. It was concluded that the elevation of the standing rate and the initial changes in response to exercise, were accomplished by increases or decreases in vagal activity. There was a secondary increase, 20 to 30 seconds after the onset of exercise, which was attributed to stimulation of the accelerator fibers. (Authors' abstract)

1467
Cureton, T. K.
[CARDIOVASCULAR EFFICIENCY AND ITS MAINTENANCE BY PHYSICAL EXERCISE PROGRAMS] Kardio-vaskuläre Leistungsfähigkeit und ihre Bewahrung durch körperliche Ubungsprogramme.— Sportarzt (Köln), 13 (7): 230-236. July 1962. In German.

This is a general review of the physiology of the circulatory and respiratory systems, the chief components of cardiovascular efficiency, cardiovascular efficiency tests, conclusions with respect to cardiovascular evaluation, and preventative measures against decline in cardiovascular performance. (57 references)

1468
deVries, H. A.,
and D. E. Gray
AFTEREFFECTS OF EXERCISE UPON RESTING METABOLIC RATE.—Research Quart., 34 (3): 314-321. Oct. 1963.

Resting metabolic rates of two healthy middle-aged male subjects were tested twice a week during a six-week exercise program. On one day each week observations were made at 2-, 4-, 6-, and 8-hour intervals following the exercise bout; on another day observations were made at corresponding times, but without exercise. The results of a total of 38 pairs of observations indicated a statistically significant increase in metabolic rate for a period of 6 hours, returning to approximately the pre-exercise level in 8 hours. The mean increase for the two subjects for the first 6 hours following exercise was 4.39 kcal./m^2./hr. or a total cost of 53 kcal. per day over and above the metabolic cost of the activity itself. The implications of the metabolic aftereffects of exercise making a contribution in a weight reduction program are discussed. (Authors' abstract)

1469
Donald, K. W.,
P. W. Humphreys, B. M. Kennelly, A. R. Lind, and S. H. Taylor
CARDIOVASCULAR RESPONSES TO SUSTAINED CONTRACTIONS [Abstract].—Jour. Physiol. (London), 166 (1): 18P-19P. April 1963.

Four healthy subjects were examined during sustained hand grip contractions at tensions of 10, 20 and 50% maximal voluntary contractions (MVC). Simultaneous measurements were made of cardiac output by a dye dilution method of mean blood pressure recorded from the aorta and heart rate. On a subsequent occasion blood flow through both forearms was measured at the same time as recording blood pressure or heart rate. Results from all four subjects followed a similar pattern of response; the magnitude of the responses was judged the actual experimental values from one subject before, during and after a 20% MVC contraction held for five minutes. Included is a representative table. Whereas the stroke volume increased during rhythmic contractions, it did not increase in the sustained contractions and the rise in cardiac output was dependent solely on the rise in pulse rate. Only small changes in systemic vascular resistance were found as compared to the marked fall usually observed during dynamic exercise. At 50% MVC the only substantial qualitative difference in response was a markedly greater postexercise hyperemia in the working muscle, presumably demonstrating an inadequate supply of blood to the muscle during the contraction. (Authors' abstract, modified)

1470
Duntsch, G.,
H. Stoboy, and H. Mellerowicz
[COMPARATIVE STUDIES OF THE ENDURANCE CAPACITY OF WOMEN AND MEN FOR WORK ON THE HAND ERGOMETER] Vergleichende Untersuchungen uber die Dauerleistungsfahigkeit von Frauen und Mannern bei ergometrischer Handkurbelarbeit. — Sportarzt (Koln), 13 (12): 391-396. Dec. 1962. In German.

One hundred female and eighty male healthy nonathletic subjects, in the age range of 20-30 years, performed maximum work on a hand-crank ergometer for 10 minutes. The women averaged a work output of 123 watt = 7500 mkg./10 min.; the men an output of 208 watt = 12700 mkg./10 min. At the end of the work the heart rate for the male subjects was 198 beats/min., for the female subjects 178 beats/min. Therefore the female subjects in this study achieved 60% of the work efficiency of men. The efficiency-weight ratio was 2.0 for the women, and 3.0 for the men. The women achieved 67% of the male work efficiency relative to body weight.

1471
Egeberg, O.
THE EFFECT OF EXERCISE ON THE BLOOD CLOTTING SYSTEM.—Scandinavian Jour. Clinical & Lab. Investigation (Oslo), 15 (1): 8-13. 1963.

Directly following short-term strenuous muscular exercise an acceleration was seen in the intrinsic blood clotting system. The acceleration was associated with a marked rise in plasma AHA (factor VIII) activity assayed with a one-stage cephalin system. Blood AHA activity immediately after exertion was 2-3 times the base level, thereafter decreasing in the following hours. Blood samples drawn one day after exercise, or later, showed base AHA levels. Plasma thromboplastin time was unaltered. No marked changes were observed in the other clotting factors measured. (Author's summary, modified)

1472
Egeberg, O.
ON THE NATURE OF THE BLOOD ANTIHEMOPHILIC A FACTOR (AHA=F. VIII) INCREASE ASSOCIATED WITH MUSCULAR EXERCISE.—Scandinavian Jour. Clinical and Lab. Investigation (Oslo), 15 (2): 202-203. 1963. In English.

Three adult healthy males were subjected to repeated standard exercise tests. A high increase of the antihemophilic A factor (AHA) was observed only after the first 1-3 exercise tests. On the following days, the exercise increase in AHA was moderate or disappeared. Renewed reactions, although less than after the first test, were observed after five days without strenuous exercise. These results are interpreted as consistent with the hypothesis that AHA activity is drained with tissue fluid and lymph from reticulo-endothelial sources.

1473
Eiselt, E.
[RESPONSE OF THE CARDIOVASCULAR AND RESPIRATORY SYSTEM TO MUSCULAR WORK] Odezva kardiovaskulárního a respiračního aparátu na svalovou práci. — Pracovní lékařství (Praha), 14 (5): 239-243. 1962. In Czech, with English summary (p. 243).

Methods for the assessment of the stroke and minute volume of the heart are reviewed. Changes in the stroke and minute volume after work measured by the rheoplethysmographic method suggest that the response of the cardiovascular apparatus is the more expedient the more the stroke volume increases after intense work. Different methods of examination of the respiratory function are compared and the conclusion is reached that the relatively simple method of Pelnar, i.e., respiratory equivalents at rest and maximum values after work, provides sufficient information on the efficiency of the circulation and lungs. With advancing age the O_2 consumption and CO_2 output at rest decline, but during work both indicators are higher than in the young adults. Intense physical training during adulthood improved the utilization of O_2 even in the seventh decade. (From the author's summary)

1474
Elsner, R. W.,
and L. D. Carlson
POSTEXERCISE HYPEREMIA IN TRAINED AND UNTRAINED SUBJECTS. — Jour. Applied Physiol., 17 (3): 436-440. May 1962.

Physiological responses of athletes and nonathletes to treadmill exercise at 4 m.p.h. on a 10% grade for 5 minutes were compared. Some nonathletes were studied again after 4 weeks' physical training. Whereas the increase in oxygen consumption during exercise and the oxygen debt were similar in all groups, heart rate and blood flow in the leg increased less and returned to resting values more rapidly in athletes and in trained nonathletes than in untrained nonathletes. The time required for the return of blood flow to pre-exercise levels was greater than that necessary for the repayment of oxygen debt. Circulatory changes involved in body temperature regulation during exercise had little effect on total leg blood flow. Experiments with a foot pedal exercise, with and without occlusion of circulation to the leg, suggest that athletes and trained nonathletes have greater blood flow in the muscles during exercise than do sedentary subjects. In the latter, the first few minutes after exercise without occlusion resembled recovery from exercise with occlusion, indicating that relative ischemia is normal in untrained subjects during moderate exercise. (Authors' abstract)

1475
Felman, A. L.
IMMEDIATE EFFECTS OF EXERCISE ON APPARENT LIMB MASS AND CIRCUMFERENCE.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 20 (1): 38-44. 1963. In English.

Fifty-four subjects were given a standardized elbow flexion exercise consisting of holding the arm flexed at 90° against the pull of a 20 lb. weight while in a recumbent position. Measurements were obtained on apparent weight of the arm and on upper arm and forearm circumferences during a period of 10 minutes prior to exercise and 20 minutes after exercise. The immediate postexercise upper and lower arm circumferences exceeded the resting level by 1%. At the end of the 20-min. rest period the upper arm circumferences had lost only 65% of the increase, while the forearm circumference had lost 75% of its increase. The apparent arm weight returned to within 5% of the resting level after a rest period of at least 8 to 9 minutes. (Author's summary, modified)

1476
Frick, M. H.,
A. Konttinen, and H. S. S. Sarajas.
EFFECTS OF PHYSICAL TRAINING ON CIRCULATION AT REST AND DURING EXERCISE.—Amer. Jour. Cardiology, 12 (2): 142-147. Aug. 1963.

Fourteen young men with sedentary habits were studied before and after a two-month hard training period to obtain data on the changes in hemodynamics, explored both at rest and during supine leg exercise. The physical working capacity of the subjects was markedly improved, paralleled by an increase in the heart volume. The cardiac output at rest was slightly higher after training, due to a significant increase in the stroke volume. The change in the total peripheral resistance was inversely commensurate to that of the cardiac output. The heart rate was reduced at rest in eleven of the subjects. Left heart work was unchanged, but this work was performed with a smaller oxygen cost after training, as assumed from the changes in the tension-time index. This sequence of events was even more evident in the circulatory adjustment during exercise, characterized by a larger stroke volume and a significantly lower heart rate than before training. (Authors' summary)

1477
Friedberg, S. J.,
P. B. Sher, M. D. Bogdonoff, and E. H. Estes
THE DYNAMICS OF PLASMA FREE FATTY ACID METABOLISM DURING EXERCISE. — Jour. Lipid Research, 4 (1): 34-38. Jan. 1963.

Palmitic acid-1-C^{14} was given intravenously to volunteer subjects before, and toward the end of, 35-45 minutes of exercise. The fractional turnover rate and total turnover rates for plasma free fatty acids were greater during exercise. The concentration of free fatty acids in the plasma fell at the beginning of exercise, then rose and exceeded the resting levels. Immediately after exercise, there was a further abrupt rise and then another decline. The results indicate that exercise accelerates the efflux of plasma free fatty acids and then, secondarily, increases mobilization of free fatty acids from depots. (Authors' summary)

1478
[Gonţea, I.] Gontsia, IA.,
[P. Şuţescu] P. Shutsesku, and S. Dumitraki
[HUMAN PROTEIN REQUIREMENTS DURING WORK PERFORMANCE] Potrebnost' cheloveka v belke v protsesse truda.—Voprosy pitaniia (Moskva), 22 (3): 3-8. May-June 1963. In Russian with English summary (p. 8).

Eight males were kept on a diet containing 1 mg. of protein per kg. of body weight for approximately 30 days. The first 12 days constituted the preliminary stage. During the remaining period the subjects performed six muscular exercises per day of a duration of 20 min. Although the caloric intake was 10% in excess of energy expenditures, the nitrogen balance turned negative on the first day of the second period. During the following 3-4 days further loss of body nitrogen was observed. However, at the end of the experiment the loss was smaller than at the beginning and the nitrogen expenditure fell by 75-85%, while the energy expenditure diminished only by 20%.

1479
[Gonţea, I.] Gontzea, J.,
and [P. Şuţescu] P. Schutzescu
[NITROGEN LOSS THROUGH PERSPIRATION DURING PHYSICAL WORK] Stickstoffverluste mit dem Schweiss bei Muskelarbeit.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 20 (1): 90-109. 1962. In German.

Samples of sweat were collected from different body sites of 30 healthy men in the course of 28 to 52 days under a strictly controlled work, rest, and food regimen in the laboratory. The ranges of variation in the nitrogen content of sweat from one body part to another and from one individual to another were established. The nitrogen content of sweat decreases during the day inversely to the duration of physical work. Increase in perspiration rate above 400 g./hour is accompanied by decrease in the nitrogen content. Increase of protein intake from 65-75 g. to 105-115 g. per day was followed by an 18.5% increase in the nitrogen content in sweat. During physical work at 35°C. the nitrogen losses through perspiration rose by 45%. In general, the nitrogen loss through skin during physical work amounts to 22% at 20°C. and 28% at 35°C. of the total nitrogen loss through the kidneys and skin. (40 references)

1480
Grimby, G.,
and B. Söderholm
ENERGY EXPENDITURE OF MEN IN DIFFERENT AGE GROUPS DURING LEVEL WALKING AND BICYCLE ERGOMETRY. — Scandinavian Jour. Clinical and Lab. Invest. (Oslo), 14 (4): 321-328. 1962.

Heart rate, ventilation volume, and oxygen uptake were determined in level walking and bicycle ergometry in healthy men 20-65 years of age. The relationship between heart rate and oxygen consumption was independent of age and type of work. The ventilatory equivalent (ventilation per liter oxygen uptake) was higher in the older subjects during walking. The oxygen consumption was the same in various ages during cycling, but increased with age during walking. Equations are given for the prediction of oxygen consumption at level walking. These provide an approximate estimation of the load of oxygen transportation at different speeds, but determination of the actual oxygen uptake should be made if a more thorough analysis of physical fitness is desired. (Authors' summary, modified)

1481
Hansen, J. W.
THE TRAINING EFFECT OF DYNAMIC MAXIMAL RESISTANCE EXERCISES.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (6): 420-424. 1963. In English.

Seven subjects participated in a training program of 10 maximal resistance dynamic exercises a day. The training period was 5 weeks. The left elbow flexors were trained. Before and after the training period the dynamic strength, the isometric strength, the dynamic endurance, and the isometric endurance were tested. The training resulted primarily in an increase of the dynamic and isometric strength, while the dynamic endurance (working capacity) remained nearly unaltered compared with the increase seen in previous experiments. The isometric endurance too remained unaltered. (From the author's summary)

1482
Hansen, J. W.
THE EFFECT OF SUSTAINED ISOMETRIC MUSCLE CONTRACTION ON VARIOUS MUSCLE FUNCTIONS.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (6): 430-434. 1963. In English.

The isometric endurance of the left elbow flexors was trained 10 times daily until exhaustion. The load was 60% of 1 RM (repetition maximum). The elbow joint was kept flexed 90°, the forearm being horizontal. The training period was 5 weeks with no training on Sundays. Before and after the experiment the subjects had tests of dynamic strength, isometric strength, dynamic endurance, isometric endurance, and the ability to perform repeated isometric contractions of 5 seconds duration, interrupted by an interval of 2 seconds. The training increased the isometric endurance by 84% and the ability to perform repeated isometric contractions by 21.9%. On the other hand, the dynamic endurance was only increased by 92.5%, a slight increase when compared with that which may result from experiments training the dynamic endurance. The effect upon the isometric and dynamic strength was moderate, an increase of 11% and 15.4% respectively--moderate when compared with what is obtained by training with maximum loads. (Author's summary, modified)

1483
Hess, P.,
and J. Seusing
[THE EFFECT OF STEP FREQUENCY AND THE PEDAL PRESSURE ON THE OXYGEN UPTAKE IN ERGOMETRIC STUDIES] Der Einfluss der Tretfrequenz und des Pedaldruckes auf die Sauerstoffaufnahme bei Untersuchungen am Ergometer.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (6): 468-475. 1963. In German.

Analysis of the results of a series of stress experiments with the Fleisch ergometer revealed the significance of pedal pressure and step rate for the achieved level of oxygen uptake. The ergometric work performance is a function of pedal pressure and step rate and may be defined accurately physically in terms of both of these factors. However, the measurements of oxygen uptake showed that the magnitude of the physical load does not always correspond to the actual stress on the organism. In order to have an optimum effect, it is very important how the level of pedal pressure and the magnitude of step rate are correlated. An attempt is made to explain this observation by the differences in work conditions which are achieved by variations of the values for pedal pressure and step rate. (Authors' summary, modified).

1484
Highman, B.,
and P. D. Altland
EFFECTS OF EXERCISE AND TRAINING ON SERUM ENZYME AND TISSUE CHANGES IN RATS.—Amer. Jour. Physiol., 205 (1): 162-166. July 1963.

Young adult male rats received 1-20 successive daily 6-hour exercise tests in a rotating cage. Serum glutamic oxalacetic transaminase and aldolase and blood urea nitrogen values rose sharply and serum alkaline phosphatase fell immediately after each of the first four tests with only partial recovery after an overnight rest. Subsequently, the serum alkaline phosphatase and blood urea nitrogen values returned to normal, but the transaminase and aldolase values were slightly elevated even after 17-20 tests. Weight loss was 15% in 3-6 days and 7% after 17-20 tests. Transient fatty changes were noted in the thigh muscles after the first test. Necrotic muscle lesions, most pronounced after three tests, regressed after the first week. Rats given 17-20 successive daily 6-hour exercise tests, contrary to untrained rats, showed no apparent fatigue, no muscle lesions, and no significant changes in serum enzymes immediately after a 16-hour exercise test. These findings emphasize the importance of properly graded training exercise (Authors' abstract)

1485
Horvat, V.
THE EFFECT OF TRAINING ON MAXIMAL OXYGEN INTAKE AND PULSE RECOVERY RATE [Abstract].—International Congress of Physiological Sciences, 22 (Leiden, 1962), Proceedings, vol. 2, no. 738. Amsterdam [1962?].

Twelve college men were trained for rowing. This is one of the most exhausting exercises. The first part of the three months of the training consisted of indoor activities such as weight lifting and skipping. The second part of three months consisted of actual rowing. The subjects were tested before the first and after the second training period on the motor-driven treadmill. Maximal oxygen intake and pulse recovery rate after standardized treadmill run were taken as criteria of training effects. After the first part of the training maximal oxygen intake remained unaltered but the pulse sum for three minutes of recovery decreased from 343 to 281. After the second part of the training maximal oxygen intake increased from 4,097 liters/minute to 4,569 liters/minute and pulse in recovery decreased from 281 to 264. It is concluded that the practice of indoor activities has no influence on the maximal oxygen intake but only on pulse recovery rate. Rowing practice could increase the maximal intake and decrease pulse recovery rate. The results of the tests agreed well with the success of the rowing championship. (Author's abstract)

1486
Humphreys, P. W.,
and A. R. Lind
BLOOD FLOW THROUGH ACTIVE MUSCLES OF THE FOREARM DURING SUSTAINED HAND-GRIP CONTRACTIONS [Abstract]. — Jour. Physiol. (London), 162 (1): 18P-19P. Aug. 1962.

Changes in temperature were measured by thermocouples in both active and inactive muscles during and after contractions when the forearm was previously cooled in a water bath of 18° or 26° C. Large rises of temperature were observed in the active muscles, little or no change in inactive muscles. The conclusion that this reflects an increase in blood flow through the active muscle was supported by the observations that (1) the rise of temperature in the active muscles was abolished by artificial occlusion, and (2) it was reversed in the pre-heated forearm. Sustained contractions without artificial occlusion were of longer duration than those with the circulation occluded. (From the authors' abstract)

1487
IAkovlev, N. N.
[GAMMA-AMINOBUTYRIC ACID METABOLISM IN THE CEREBRAL HEMISPHERES DURING MUSCULAR EXERTION OF VARYING DURATION] Obmen γ-aminomaslianoi kisloty v bol'shikh polushariiakh golovnogo mozga pri myshechnoi deiatel'nosti razlichnoi dlitel'nosti.—Ukrain'sky biokhimichnyi zhurnal (Kyiv), 35 (2): 175-187. 1963. In Russian, with English summary (p. 187).

Rats were required to swim in a water bath (28-30° C.) for 5 to 750 minutes and were sacrificed immediately after the exertion. The concentrations of γ-amino-butyric acid (GABA) in the cerebral tissue decreased at the beginning of exertion, remained at a stationary level for some time, and began to increase with the progressively developing fatigue of the animals. The changes in GABA concentrations were directly proportional to the activity of glutamic acid decarboxylase and inversely proportional to the aerobic elimination of GABA; in turn the glutamic acid decarboxylase activity as well as the aerobic elimination of GABA were directly proportional to the phosphopyridoxalkinase activity. The decrease of the glutamic acid decarboxylase activity following the initial period of intense muscular exertion could be related to the pyridoxal, and in prolonged exertion to the decrease of the phosphopyridoxalkinase activity. It is concluded that γ-amino butyric acid is related to the inhibitory processes in the central nervous system.

1488
Iampietro, P. F.,
and R. F. Goldman
PREDICTION OF ENERGY COST OF TREADMILL WORK. — Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Oklahoma, and Army Research Inst. of Environmental Medicine, Natick, Mass.; issued by Civil Aeromedical Research Inst. Report no. 62-5, April 1962. 4 p.

The relative contributions of rate of progression (1.5 to 4.0 m.p.h.), grade (4 to 9%), and load (10 to 30 kg.), to the total energy cost of treadmill work were determined from measurements of oxygen consumption. The data obtained were integrated graphically with some of the available energy cost data in the literature. A useful graph is provided for estimating energy expenditure. It was tentatively concluded that for grade walking over the ranges studied, the energy cost per unit weight is essentially the same whether the weight is of the body or the load. The data are useful in that a correlation between the diverse literature reports on treadmill studies using different speeds and loads is made feasible. (Authors' abstract)

1489
Isaakian, L. A.,
R. P. Ol'nianskaia, and G. A. Trubitsyna
[EFFECT OF TEMPERATURE ON GASEOUS METABOLISM AND BIOELECTRICAL ACTIVITY OF BRAIN AND MUSCLES OF MAN DURING MUSCULAR EXERTION] O vliianii temperaturnykh vozdeistvii na gasovyi obmen i bioelektricheskuiu aktivnost' mozga i myshts u cheloveka pri myshechnoi rabote. — Doklady Akademii nauk SSSR (Moskva), 146 (3): 728-730. 1962. In Russian.

Five subjects were required to lift weights during a 3-minute work period. There was a 25-52% increase of the gaseous metabolism which remained elevated even 5 min. after the termination of the exercise. These changes were accompanied by an increase of the action potentials of the forearm flexors and a suppression of the alpha rhythm of the electroencephalogram. When the arm was warmed with water bottles, no significant changes were observed. When the arm was cooled, however, the gas metabolism increased 15-20% and one minute later the alpha rhythm was suppressed; an increase in the action potentials did not always occur. It is concluded that the differences observed could be explained by influences of the temperature-regulating mechanisms.

1490
Ivanova, M. P.
[CHANGES IN THE BIOPOTENTIALS OF THE HUMAN BRAIN IN CONNECTION WITH PHYSICAL WORK] Izmenenie biopotentsialov mozga cheloveka v sviazi s fizicheskoi rabotoi. — Zhurnal vysshei nervnoi deiatel'nosti (Moskva), 12 (2): 202-207. March-April 1962. In Russian, with English summary (p. 207).

English translation by U. S. Joint Pub. Research Serv. (Washington), no. 14,796 (OTS: 62-11732), Aug. 10, 1962. p. 1-15. (Available from Office of Technical Services, U. S. Dept. Commerce)

Eleven subjects lifted a 2 kg. load on a shoulder ergometer at predetermined rates and durations. Bipolar electroencephalograms were taken from the occipital-parietal area and the rolandic areas of the left cerebral hemisphere. Analysis of the tracings led to the conclusion that during dynamic work a phase of depression of the biopotentials may occur at the start or throughout the work alternating with normal alpha rhythm. The duration of the alpha depression usually decreases with repeated lifts; however, when muscular fatigue sets in, it increases again. Occasionally phasic changes can be seen in the duration of the alpha depression; in various cycles of work it usually changes according to the performance time of these cycles.

1491
Kesseler, K.
[THE EFFECT OF EXERCISE ON THE BASAL METABOLISM IN MAN] Die Trainingswirkung auf den Ruhe-Nüchternumsatz des Menschen.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (6): 435-458. 1963. In German.

In a series of experiments the effect of chronic ergometric exercise of 150 W, carried out for 8 weeks, 10 minutes each day, was explored in relation to the human basal metabolism. Under these conditions there was a significant lowering of the basal metabolism in addition to certain effects on respiration and circulation. This effect of training was, however, subject to seasonal influences, in that it could be clearly observed only in summer with the present regimen of exercise. (From the author's summary) (49 references)

1492
Kniazev, I. I.,
and V. V. Matov
[TELEMETRIC ELECTROCARDIOGRAPHIC STUDIES DURING HEAVY PHYSICAL EXERCISES] Radioteleelektrokardiograficheskoe issledovanie vo vremia vypolneniia bol'shikh fizicheskikh nagruzok.—Teoriia i praktika fizicheskoi kul'tury (Moskva), 25 (6): 65-68. June 1962. In Russian.

Telemetric electrocardiographic data were obtained from the following three test groups engaged in running: nonathletes, moderately trained athletes, and professionals. The cardiac responses of the first group were characterized by a P-Q interval of 0.08-0.09 sec., frequent superimposition of P and T waves, and 206 to 214 beats per minute; the responses of the second group were in general similar to the first group, with 196-200 beats per minute; while in the third group 180-187 beats per minute and a longer systolic period were recorded.

1493
Knuttgen, H. G.
OXYGEN DEBT, LACTATE, PYRUVATE, AND EXCESS LACTATE AFTER MUSCULAR WORK. —Jour. Applied Physiol., 17 (4): 639-644. July 1962.

Four series of experiments were conducted with the subject riding a Krogh bicycle ergometer at work rates of 300, 700, 1,100, and 1,600 kg.-m./minute. Oxygen debts were contracted at each of the work levels, but no appreciable rises in excess lactate and only small rises in total lactate were found at the lower two intensities. When a critical level of work (O_2 uptake of 1.5 liters/minute with an accompanying debt of 1.5 liters) was surpassed there was a rapid rise in O_2 debt values which was parallel to rises in O_2 equivalence values for both total lactate and excess lactate. At all work levels the O_2 debt surpassed in quantity the O_2 equivalents of the maximum increases in total lactate and, to an even greater extent, the O_2 equivalents of excess lactate. This finding supports the theory of separate alactacid and lactacid portions of the O_2 debt. No conclusions could be drawn concerning the rates or methods of payment of the two portions. (From the author's abstract)

1495
Konttinen, A.,
and T. Somer
EFFECT OF MUSCULAR EXERCISE ON PLASMA VISCOSITY IN CORRELATION WITH POSTPRANDIAL TRIGLYCERIDEMIA.—Jour. Applied Physiol., 18 (5): 991-993. Sept. 1963.

The correlation between postprandial triglyceridemia and plasma viscosity was studied in 45 healthy young men. One half, 23, of them carried out a heavy march lasting two hours while the other half, 22, rested in bed. Serum triglycerides and plasma viscosity were determined before the fat meal and 4 and 6 hours postprandially. Serum total proteins and hematocrits were measured simultaneously. Despite significantly higher postprandial triglyceridemia in the resting group no rise was seen in plasma viscosity, whereas, in the exercise group with a lower triglyceride level a significant elevation took place in plasma viscosity. (Authors' abstract)

1496
Korobkov, A. V.
[PHYSICAL EXERCISE AS A MEANS OF MAINTAINING THE CONSTANCY OF THE INTERNAL MILIEU OF THE COSMONAUT'S BODY] Fizicheskie uprazhnenie kak sredstvo sokhraneniia postoianstva vnutrennei sredy organizma kosmonavta.—Problemy kosmicheskoi biologii (Moskva), 2: 68-73. 1962. In Russian, with English summary (p. 73).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 72-77. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

A review is presented of the value of systematic physical training for the preservation of internal homeostasis, neuromuscular function, metabolic processes, etc. The specific effects of physical exercise noted are increased tolerance of pressure breathing, increased resistance to motion sickness, increased tolerance of immobilization, etc. In conditions of weightlessness physical exercise (activation of the motor function) is the only way to provide for the necessary flow of reflex, triggering, and trophic impulses brought about by activity on the earth. For space flight systematic physical training should be based on the formation of the best topography of the functions of various muscle groups as related to the gravitational forces and vigorous motor activity.

1497
Koroxenidis, G. T.,
A. Corcondilas, and J. T. Shepherd
THE TIME OF ONSET OF VASODILATATION FOLLOWING A BRIEF CONTRACTION OF THE FOREARM MUSCLES [Abstract]. —Physiologist, 5 (3): 170. Aug. 1962.

With the use of Whitney mercury-in-rubber strain-gauge plethysmographs, an attempt was made to time the onset of vasodilatation in the forearm following single short contractions of the forearm muscles of 0.25 to 0.35 second duration. An increase in blood flow to the forearm can be detected within a second following the end of the contraction. The brachial artery pressure did not change except for a fall in diastolic pressure confined to the beat concomitant with the contraction. Since the rate of increase in forearm volume with venous occlusion is linear over 6 seconds, it is concluded that the increase in flow is due to dilatation of forearm muscle vessels. The same response is present in the sympathectomized forearm, and since no changes are seen on the control side in normal subjects, the vasodilatation is considered to be locally mediated. The flow is at its maximum immediately after contraction and subsides rapidly to the resting level. Over the range of contractions examined, there is an approximately linear relationship between the strength of the contraction and the increase in flow. The speed of onset of the dilatation resulting from this local mechanism makes it unnecessary to postulate a dilatation mediated by the central nervous system to account for the immediate circulatory adjustments that occur in muscles at the onset of exercise. (Authors' abstract)

1498
Kubík, S.
[EXPERIMENTAL STUDY ON DIURNAL VARIATIONS OF EOSINOPHILS IN RESTING AND WORKING SUBJECTS. III. AN ATTEMPT OF QUANTITATIVE ANALYSIS OF EOSINOPHIL REACTION AFTER PHYSICAL STRESS] Experimentálna štúdia o dennom kolísaní eozínofilov u l'udí v kl'ude a pri práci. III. Pokus o kvantitatívnu analýzu eozínofilovej reakcie po fyzickom zatažení. —— Pracovní lékařství (Praha), 14 (1): 11-14. 1962. In Czech, with English summary (p. 14).

Quantitative analysis was attempted of the eosinophil reaction to standard physical exertion on the bicycle ergometer. The organism responds regularly with an increase of eosinophils to a certain physical loading. This response is quantitative in that it increases or decreases as a function of the quantity of exertion. It is possible to use it for the quantitative evaluation of stress within a certain range, e.g., as an estimate of stress connected with physical work. (From the author's summary)

1499
Lamb, J. F.
OSCILLATIONS OF HEART RATE AFTER EXERCISE IN MAN [Abstract].—Jour. Physiol. (London), 168 (2): 55P-56P. Sept. 1963.

Cardiac arrhythmias studied in 50 subjects are described. In about half the subjects studied on one occasion only, the heart rate returned from the exercise rate of about 140/min. to the resting level smoothly. In the others the heart rate slowed smoothly from the exercise level to about 110 beats/min. and then showed a waxing and waning of the rate between this and about 40 beats/min. A typical record from one of the subjects is presented, in which each pulse interval, expressed as a frequency, is plotted against the time elapsed since the end of exercise. Typically the heart rate fell from the highest to the lowest rate within one beat and then recovered more slowly, the half-time of recovery being about 1 sec. There was no obvious relation to respiration, so that this effect is probably not a form of sinus arrhythmia. Results, suggesting that the vagus often acts after exercise in man by periodic rather than sustained activity, and that this gives rise to large fluctuations, are discussed. (Quoted in part)

1500
Larsen, E. M.
FINGER AND SUBLINGUAL TEMPERATURE CHANGE INDUCED BY MUSCULAR ACTIVITY [Abstract]. —— Physiologist, 5 (3): 172. Aug. 1962.

Twenty-four young adults, dressed in street clothes, refrained from physical activity, ingestion of food or fluid, and smoking immediately prior to the experiment. During 2-3 minutes the subject briskly climbed the stairs to the fifth floor and down to the laboratory. After activity both sublingual and finger temperatures decreased in 21 subjects. Finger temperature decreases ranged from 0.1 to 14.0° F. with an average of 6.1° F., while sublingual temperatures decreased by 0.5 to 4.0° F. with an average of 1.3° F. The mechanism involved probably consists essentially of nerve impulses initiating muscular activity and increasing peripheral vasoconstriction. The increased vasoconstriction may be maintained or augmented by reflex stimulation of the vasomotor center from multiple areas including active muscles. The temperature decreases confirm the concept of increased peripheral vasoconstriction during strenuous muscular activity. (Author's abstract, modified)

1501
Lubańska, L.
[HEMATOLOGICAL CHANGES INDUCED BY MUSCULAR WORK IN THE BONE MARROW AND PERIPHERAL BLOOD OF ALBINO RATS] Zmiany hematologiczne szpiku kostnego i krwi obwodowej białych szczurów pod wpływem pracy mięśniowej. —— Acta physiologica polonica (Warszawa), 13 (1): 45-56. 1962. In Polish, with English summary (p. 55-56).

Thirty-seven rats were run to exhaustion on a track. They were removed in groups after 20-, 50-, and 72-minute runs, weighed, decapitated, and the bone marrow extracted from the femur. Morphological analysis of the peripheral blood showed a rise in the number of erythrocytes by 28% after 20 min. of work, a further rise to +33% after 50 min. of work, and to +50.8% after 72 min. of work. The increase was mostly from bone marrow depots with an intensification of normoblastic erythropoiesis in the marrow. The number of polychromatic and orthochromatophilic erythroblasts diminished with prolonged work. Leukocyte response to physical work was biphasic in nature: after 20 min. of work the leukocyte count increased by +242.2%, it fell to +35.4% above initial level after 50 min. of work, and after 72 min. of work finally sank to 43.7% below the initial level. This pattern was associated with extensive leukopoiesis. Protracted physical effort (50 and 72 min.) resulted in marked changes in the numbers of neutrophilic myelocytes, metamyelocytes, and segmented cells. (Author's summary, modified)

1502
Lukin, L.
INSTABILITY OF THE "STEADY STATE" DURING EXERCISE.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 20 (1): 45-49. 1963. In English.

The "steady state" of oxygen consumption of exercise is only relatively steady; considerable fluctuation in the rate of oxygen consumption occurs from minute to minute. The standard deviations expressed in per cent of mean O_2 consumption are smallest with a moderate work load which requires a certain effort and concentration of the subject; they are greater at either extreme of work load. The instability of the "steady state" of exercise appears to be a normal phenomenon. (Author's summary)

1503
Majstruk, T.
[HISTOCHEMICAL INVESTIGATIONS ON THE GLYCOGEN CONTENT IN MOTOR NEURONS OF THE SPINAL CORD OF THE GUINEA PIG UNDER EXPERIMENTAL CONDITIONS] Obserwacje histochemiczne nad wystepowaniem glikogenu w neuronach ruchowych rdzenia kregowego swinki morskiej w warunkach doswiadczalnych.—Annales Universitatis Mariae Curie-Skłodowska (Lublin), 9: 111-122. 1960 (publ. 1962). In Polish, with English summary (p. 120-121).

Using histochemical methods, the glycogen content was studied of the motor neurons in the ventral horns of cervical and lumbar ganglia in the guinea pig after undergoing muscular exertion (running in a drum for 30-60 minutes). In the motor neuron at rest, glycogen occurred in the form of grains of various sizes entering the Nissl bodies and located in the neuroplasm and dendrites. After muscular exertion, glycogen had decreased in the corresponding neurons of the spinal cord.

1504
Margaria R.
A HISTORICAL REVIEW OF THE PHYSIOLOGY OF OXYGEN DEBT AND STEADY STATE IN RELATION TO LACTIC ACID FORMATION AND REMOVAL.— Wychowanie fizyczne i sport (Warszawa), 7 (1): 11-28. 1963. In English.

A critical review is presented of oxygen debt in relation to the formation and removal of lactic acid in the course of muscle activity. This includes a discussion of glycolysis and oxygen uptake during light and heavy work. Experiments were also conducted on performing work at various intensities for 0.5- to 10-minute durations. It was found that if work proceeded until exhaustion, the amount of lactic acid formed per minute increased linearly with the intensity of exercise. When the exercise leads to exhaustion, oxygen consumption reaches a maximum. Maximal amounts of the oxygen debt are calculated, and the relation of the oxygen debt to athletic exercise is discussed.

1505
Margaria, R.,
P. Cerretelli, P. E. diPrampero, C. Massari, and G. Torelli
KINETICS AND MECHANISM OF OXYGEN DEBT CONTRACTION IN MAN. — Jour. Applied Physiol., 18 (2): 371-377. March 1963.

Oxygen consumption, along with lactic and pyruvic acid in blood, were measured throughout the performance of heavy muscular exercise of different intensities, all leading to exhaustion in 1-10 minutes. Oxygen consumption increases exponentially with time; the maximum level attained seems to be independent of the intensity of exercise except in exercises of very high intensity and short duration, when it seems to be slightly increased. The rate of increase of oxygen consumption increases with the intensity of exercise. Pyruvic acid in blood increases exponentially also, and a steady state is reached at a level which tends to be higher, the heavier the exercise. Lactic acid increases as a linear function of time, the line eventually flattening down only toward the end of the exercise when the maximal values of lactic acid are reached. The lactic acid increase, grams per minute, is a linear function of the intensity of exercise; no lactic acid is produced if the exercise is below 220 cal./kg./min., or a higher value for athletes. (From the authors' abstract)

1506
Mathews, D. K.,
R. Bowers, E. Fox, and W. Wilgus
AEROBIC AND ANAEROBIC WORK EFFICIENCY.— Research Quart., 34 (3): 356-360. Oct. 1963.

Oxygen consumption was determined for seven subjects who rode a bicycle ergometer at 60 r.p.m. under three different pace conditions. The first condition involved a steady pace with a work load of 200 watts/minute. The second consisted of a light-heavy pace in which the work load was heavier every two minutes; the subjects worked at 100 watts for the first two minutes, 200 watts for the next two minutes, and 300 watts for the last two minutes. The third condition was a heavy-light pace which was an exact opposite of the second condition. The total time taken for each exercise condition was six minutes. Net oxygen consumption was measured for each of the three conditions. The steady pace was found to be significantly more efficient. (Authors' abstract)

1507
Meyer, F. R.,
S. Robinson, J. L. Newton, C. H. Ts'ao, and L. O. Holgersen
THE REGULATION OF THE SWEATING RESPONSE TO WORK IN MAN [Abstract]. — Physiologist, 5 (3): 182. Aug. 1962.

A series of 50-minute treadmill work experiments was carried out on men, and sweating was measured at frequent intervals over various points of the body. When the intensity of work was varied and temperature held at 25° C., the acceleration of sweating, the steady state during work, and the decline of sweating following work were closely related to changes of temperature in the working muscles and in the femoral veins draining blood from the leg muscles. When work was constant (4.5 m.p.h., 9% grade) and the temperature varied from 15° to 40° C., the mean skin temperature varied with the environmental temperature. In this series sweating increased with the increments in skin and environmental temperature without corresponding changes in the deep body temperatures. Sweating appears to be regulated in these experiments by reflex effects originating from thermal receptors in the muscle or in the veins draining the muscles and summated with reflexes from cutaneous thermal receptors. These both act through the hypothalamic center. (Authors' abstract, modified)

1508
Michael, E. D.,
S. M. Horvath, and M. A. Johnson
LOCAL METABOLITES AND THE CIRCULATORY ADJUSTMENTS TO EXERCISE.—Research Quarterly, 34 (1): 64-69. March 1963.

Four male subjects exercised on a friction-type bicycle at work loads of 900 and 2,100 kg.-meters/minute for periods of time ranging from 1/2 to 10 minutes. Recovery from the exercise was permitted with uninterrupted lower leg circulation at one time and with leg circulation occluded during the first two minutes of recovery at another time. When the circulation of the lower limbs was occluded during recovery from exercise, systolic and diastolic blood pressures were always elevated above those found when there was uninterrupted circulation following exercise. When the heat rate was below 140 beats/minute, occluding the circulation at the end of exercise always resulted in suddenly decreased heart rates. Occluding the circulation during recovery when rates were above 140 beats/minute prevented this sudden fall in heart rate levels. When circulation was restored to the legs, systolic and diastolic blood pressures suddenly decreased approximately 60 mm. Hg. Heart rate responses were dependent upon the heart rate level at the time the occluding cuffs were released. When the heart rate was less than 110 beats/minute the rate suddenly increased but when the heart rate was above 110 beats/minute there was no change. There were indications that local exercise metabolites could elicit reflexive blood pressure increases following both light and heavy work loads. The heart rate response to exercise appears to be related to factors such as the amount of metabolites trapped, and is modified by factors such as sudden blood pressure changes relative to the heart rate level. (Authors' abstract)

1509
Mies, H.
[ON THE STEADY STATE AND THE INTERMITTENT TYPE OF TRAINING] Über das "Steady State" und das Intervalltraining.—Schweizerisch Zeitschrift für Sportmedizin (Genève), 11 (1): 1-16. 1963. In German, with English summary (p. 13).

The attainment of a steady state, i.e., equilibrium between the catabolic and anabolic processes during work should be judged only on the basis of continuous measurement of a series of physiological functions. Even the length of time of the effort (minimum 3 minutes) and the relationship between the muscle mass exercised to the total muscle mass are of importance. Blood lactic acid level has long been regarded as a particularly significant indicator of the state of metabolism during and after exercise. More recent studies have demonstrated that the liver and lungs are capable of storing and releasing lactic acid. Therefore, the blood lactic acid may also have a regulatory function which requires further clarification of its role in the adjustment and recovery processes. In the intermittent form of exercise, in which the phases of effort and of recovery (during the rest interval) alternate, the duration of the effort on each occasion is too short to enable a state of equilibrium to occur. The regular rest intervals, though, may facilitate a kind of stationary state. (From the author's summary) (79 references)

1510
Milic-Emili, G.,
J. M. Petit, and R. Deroanne
MECHANICAL WORK OF BREATHING DURING EXERCISE IN TRAINED AND UNTRAINED SUBJECTS. —Jour. Applied Physiol., 17 (1): 43-46. Jan. 1962.

The mechanical work of breathing was measured from simultaneous records of esophageal pressure and tidal volume on seven well trained and seven untrained subjects exercising on a bicycle ergometer. At any given value of pulmonary ventilation, mechanical work of breathing was found to be the same for untrained and trained subjects. At any given value of oxygen uptake, pulmonary ventilation and, accordingly, mechanical work of breathing were found to be smaller in trained than in untrained individuals. (Authors' abstract)

1511
Millahn, H. P.,
and H. Sollmann
[THE BEHAVIOR OF STROKE VOLUME AND PULSE RATE AFTER GRADED PHYSICAL STRESS] Das Verhalten von Schlagvolumen und Pulsfrequenz nach dosierter körperlicher Belastung. —Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (3): 143-148. 1962. In German.

Analysis of cardiovascular functions was undertaken in 20 male subjects, average age 21.6 years, before and after a physical load of 100 W or 10 kg.m./sec. Two minutes after physical stress the circulatory system exhibited a marked shift in the ergotrophic direction. Twenty minutes after the exercise, the heart rate returned to initial values, while the stroke volume was still above normal. The stroke volume was considerably slower to return to the initial value after physical stress than the heart rate. Stroke volume and peripheral vascular resistance were in an almost perfect inverse relationship to each other after physical load. No qualitative differences could be observed between athletic and non-athletic subjects.

1512
Miller, H.
B. Issekutz, and K. Rodahl
EFFECT OF EXERCISE ON THE METABOLISM OF FATTY ACIDS IN THE DOG.—Amer. Jour. Physiol., 205 (1): 167-172. July 1963

Dogs with indwelling arterial and venous catheters worked on a treadmill for 25-30 minutes. Exercise decreased the plasma free fatty acid (FFA) concentration and increased the blood glucose. In the postexercise period, the plasma inorganic phosphorus showed a significant decrease. Experiments with C^{14}-palmitate and C^{14}-oleate showed that the decrease of the plasma FFA was due partly to an elevated uptake and partly to a reduced rate of release into the blood. Infusions of sodium lactate to resting dogs induced a marked increase in specific activity of plasma FFA, due to an inhibition of release. In spite of the reduced rate of release of FFA, the oxidation of the C^{14}-fatty acid was considerably increased during exercise (three- to fourfold). No direct relationship seems to exist between the turnover rate of plasma FFA and the rate of oxidation of fatty acids. (Authors' abstract)

1513
Missiuro, W.,
H. Kirschner, and S. Kozłowski
[ELECTROMYOGRAPHIC MANIFESTATIONS OF FATIGUE DURING WORK OF DIFFERENT INTENSITY] Elektromiograficzne przejawy zmęczenia przy pracy o różnej intensywności. — Acta physiologica polonica (Warszawa), 13 (1): 11-23. 1962. In Polish, with English summary (p. 22-23).

Fifteen subjects lifted on a manual ergograph weights (8 and 2 kg.) at a rate of 30 times a minute and a constant amplitude of movements. Action potentials were recorded from the muscles biceps brachii and triceps brachii with contact electrodes during work. EMG's were also recorded during a single muscular contraction with maximum load. The EMG's were analyzed quantitatively by summing the amplitudes of all discharges obtained during a particular contraction of the muscle. Intensive work (8 kg.) resulted in complete fatigue after as little as 1.5-3 minutes, whereas in low-intensity work (2 kg.) fatigue developed only after 40-140 minutes. The two intensities of work differed in both the subjective symptoms of fatigue and EMG activity. The results suggest diverse loci of fatigue for low- and high-intensity physical work. The latter is limited by exhaustion of the muscle fiber contractility, attended by increased discharges from the motor neurons at an amplitude close to that of the action potentials recorded for single muscle contractions. Work of low intensity stops because of decrease in discharge of nervous impulses to the muscle. Adequate peripheral stimuli (ischemia) result in a renewed burst of impulses to the muscle. A wider range of possibilities for compensation is seen for physical fatigue of neural origin. (From the authors' summary)

1514
Müller, E. A.
OCCUPATIONAL WORK CAPACITY. — Ergonomics (London), 5 (3): 445-452. July 1962.

Two limits should be distinguished for testing physical work capacity: maximal and occupational work capacity. Maximal work capacity is the work which yields for a few minutes the greatest oxygen intake possible for an individual. Occupational work capacity is the highest work level permissible in daily occupational work in kilocalories/minute. Up to 30 years of age the occupational work capacity is about 1/5 of the maximal work capacity. The maximal work capacity falls with increasing age until the age of 70 years when it is 2/3 its original value. Occupational work capacity remains undiminished. Work-capacity tests demanding extremely high levels of work from the individual, e.g., the step-test, determine only the maximal work capacity but do not reflect the occupational work capacity. The author has introduced a test measuring the rise of the pulse rate with increasing work on a bicycle ergometer, called the Work Pulse Index. The normal values of maximal and occupational work capacity for males and females are given in kilocalories/min. for the age range of 4 to 60 years. (Author's summary, modified)

1515
Nikkilä, E. A.,
P. Torsti, and O. Penttilä
THE EFFECT OF EXERCISE ON LIPOPROTEIN LIPASE ACTIVITY OF RAT HEART, ADIPOSE TISSUE AND SKELETAL MUSCLE.—Metabolism, 12 (9): 863-865. Sept. 1963.

Male albino rats were exercised in a circular cage rotating around a horizontal axis. The lipoprotein lipase activity of the heart, adipose tissue, and skeletal muscle of the exercised groups was compared to that of resting animals. Exercise produced a significant increase in the activity of myocardium and a decrease in the activity of the adipose tissue. (Authors' summary, modified)

1516
Nikonorova, A. I.
[ELECTROMYOGRAPHIC STUDIES DURING WORK AT DIFFERENT RATES BUT WITH THE SAME WORK OUTPUT] Elektromiograficheskoe issledovanie raboty v razlichnom tempe v predelakh odnoi i toi zhe moshchnosti.—Gigiena truda i professional'nye zabolevaniia (Moskva), 6 (5): 8-13. May 1962. In Russian, with English summary (p. 13).

Subjects were required to perform the following exercises on the manual ergometer: 60 motions per second with a load of 2.5 kg., 30 motions per second with a 5-kg. load, and 12 motions per second with a 12.5-kg. load. The electromyograms of all three exercises were essentially identical in respect to motion and type of the mechanogram, the differences in the exercise rates being expressed in the duration of the micropauses. Three types of reactions were distinguished: rapid onset of fatigue (3 to 10 minutes), and increased amplitude and summation of bioelectric currents at the end of an exercise; increased amplitude of the action potentials at the beginning of an exercise, with subsequent stabilization; and constancy of bioelectric indices during the testing period. The rapid rate-small load exercise appeared to be most suitable for the establishment of a stable dynamic type. The results obtained could be used in programming the work-rest schedules of human operators.

1517
Nunney, D. N.
FATIGUE, IMPAIRMENT, AND PSYCHO-MOTOR LEARNING.—Perceptual and Motor Skills, 16 (2): 369-375. April 1963.

The effect of impairment from physical activity on the subjective feelings of fatigue and on psychomotor learning was investigated. The subjects were divided into five groups equated on the basis of an initial trial on the Snoddy Stabilimeter. Four of the groups participated in physical activities requiring varying degrees of energy output completed in a 5-minute period (bicycle ergometer and treadmill running). The control group sat quietly. Pulse rates were taken before and after the activity and recovery periods. Following physical work or rest, the subjects performed on the stabilimeter, and rotary pursuit meter. The over-all rate of learning of the control group was significantly higher than that of the experimental groups. There were no significant differences in the stabilimeter learning rate among the four experimental groups in spite of different levels of previous energy output. Following the rest no significant differences were found among the groups in level of learning on the rotary pursuit meter. There were only very low correlations between individual pulse changes following the activities and subjective ratings of fatigue experienced. The minimum levels of fatigue and pulse changes experienced by the bicycle free-wheel group were sufficient to produce a detrimental effect on psycho-motor learning in the immediate postactivity period. Higher changes in pulse and more intense feelings of fatigue were not related to further decreases in the level of learning. (Author's summary, modified)

1518
Nykonova, V. O.
[EFFECT OF PROLONGED PHYSICAL EXERTION ON THE VITAMIN B$_1$ DISTRIBUTION IN THE TISSUES OF ALBINO RATS] Vplyv tryvaloi fizychnoi roboty na rozpodil vitaminu B$_1$ v tkaninakh bilykh shchuriv.—Ukrains'kyi biokhimichnyi zhurnal (Kyiv), 35 (2): 239-243. 1963. In Ukrainian, with English summary (p. 243).

Exposure of rats to swimming for a 3-hour period (water temperature, 28-30°C.) resulted in a decrease of the total thiamine concentration in the liver, without any quantitative changes in the concentration of free thiamine in the same organ. Concomitantly there was an increase in phosphorylized thiamine in the myocardium, while no changes were observed in the brain, kidneys, and skeletal musculature.

1519
Poortmans, J.,
E. van Kerchove, and P. Jaumain
[PHYSIOLOGICAL AND BIOCHEMICAL ASPECTS OF PROTEINURIA DURING EFFORT] Aspects physiologiques et biochimiques de la proteinurie d'effort. —— Internationale Zeitschrift fur angewandte Physiologie einschliesslich Arbeitsphysiologie (Berlin), 19 (5): 337-354. 1962. In French.

One group of athletes was subjected to minor physical exercise (bicycle ergometry for 25 minutes) and another group to intense exercise (cross-country of 8 kilometers for 30-45 minutes). Minor effort produced a decrease in diuresis which was discernable 30 minutes after recuperation. After intense effort, diuresis decreased at the end of the activity and increased gradually until it attained a value double that which existed initially at rest. On the other hand, proteinuria expressed in milligrams of proteins/milliliter/minute did not cease to increase from the beginning of exercise up till the 30th minute of recuperation in both types of effort. The limiting roles of renal plasma flow, glomerular filtration, tubular reabsorption, antidiuretic hormone, and aldosterone are discussed in relation to the probable process of the mechanism of proteinuria during effort.

1520
Poortmans, J.,
J. J. S'Jongers, A. Thys, and E. Van Kerchove
[TRANSAMINASE ACTIVITY IN TOTAL BLOOD AND IN SERUM DURING MUSCULAR EFFORT] L'activité transaminasique dans le sang total et dans le sérum au cours de l'effort musculaire.—Revue française d'études cliniques et biologiques (Paris), 8 (2): 173-175. Feb. 1963. In French, with English summary (p. 174).

Ten athletes, aged 18-27 years, were subjected to an experimental cross-country run for twenty minutes, and the transaminase activity in serum and whole blood was determined. Both glutamic oxalacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT) in the serum increased after effort, whereas in whole blood GOT decreased slightly and GPT doubled. These changes cannot be accurately explained in whole blood, but different phenomena can possibly explain the increase in serum transaminase levels. These are: hemoconcentration, higher cell membrane permeability, and histological changes at the level of the fatigued muscles.

1521
Poruchikov, E. A.
[CHANGES IN DIASTOLIC PRESSURE AND AUSCULTATORY PHENOMENA DURING PHYSICAL EXERCISES] Ob izmeneniiakh minimal'nogo davleniia i auskul'tativnykh iavlenii pri fizicheskikh nagruzkakh.—Teoriia i praktika fizicheskoi kul'tury (Moskva), 1962 (11): 66-71. Nov. 1962. In Russian.

A group of 300 athletes were examined by mechanocardiographic and electrocardiographic methods to determine true diastolic pressure values in the brachial artery against a background of "infinite tone". At rest, the average value of the tacho-oscillographic diastolic pressure was 65-75 mm. Hg, 5 to 10 mm. higher than that observed in auscultatory recordings, while after a 3-minute exercise the diastolic pressure rose on the average by 7 to 12 mm. Hg. Thereafter, the diastolic pressure fell gradually and reached normal values within a 5-minute period. Whenever the rise of diastolic pressure exceeded 15-20 mm. Hg, there was an increase in mean arterial pressure, minute volume, and reduction of the precapillary blood flow rate. The origin and auscultatory characteristics of the "infinite tone" of the brachial artery depends on the duration of contraction of the left ventricle, vascular tonus, and the value of the stroke volume. The arterial auscultation began with the shortening of ventricular contraction to 0.25 sec. or more, while further reduction of the contraction period to 0.22 sec. was always accompanied by an "infinite tone" regardless of the state of physical fitness, vascular tonus, or magnitude of stroke volume.

1522
Radermecker, M.
J. Damoiseau, R. Dercanne, and J. M. Petit
[CHANGES IN THE VENTILATORY REGIME DURING RECUPERATION FROM VARIOUS MUSCULAR EXERCISES] Modifications du régime ventilatoire pendant la récupération d'exercises musculaires variés.—Archives internationales de physiologie et de biochimie (Liège), 71 (2): 256-258. March 1963. In French.

A hypothesis is presented that the ventilatory regulation of each person is independent of the type of exercise performed. Verification of this hypothesis was sought by examining the respiratory frequency/ventilation ratio in four males (20-23 years of age) during recuperation from various exercises in which the intensity increased progressively until the subject was exhausted. Ventilatory regulation during recuperation varied according to the type of exercise. Since the thoracopulmonary mechanical properties did not differ in a significant manner either during exercise or during recuperation, no essential role was attributed to them in the determination of ventilatory regulation under these conditions. The differences in ventilatory regulation indicated only a variability of the humoral or neurogenic stimulus resulting from exercise.

1523
Rasch, P. J.,
and W. R. Pierson
ISOMETRIC EXERCISE, ISOMETRIC STRENGTH AND ANTHROPOMETRIC MEASUREMENTS.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 20 (1): 1-4. 1963. In English.

Twenty-nine young adult male subjects practiced 15 seconds of maximal isometric contractions of the elbow flexors three times a day, 5 days a week, for 5 weeks. They achieved greater increases in strength than have been claimed for a single two-thirds maximal contraction once a day, although the latter has been said to provide the maximal stimulus for the development of strength. There was a negative correlation between initial strength and strength gains. The correlation between the girth of the upper arm and elbow flexor strength, or between changes in upper arm girth and changes in elbow flexor strength, was insignificant. A significant number of subjects developed positive changes in upper arm girth, although the magnitude of such changes was not significant. (Authors' summary)

1524
Rohter, F. D.,
R. H. Rochelle, and C. Hyman
EXERCISE BLOOD FLOW CHANGES IN THE HUMAN FOREARM DURING PHYSICAL TRAINING.—Jour. Applied Physiol., 18 (4): 789-793. July 1963.

Forearm blood flow measurements were made with a venous occlusion plethysmograph on six competitive swimmers and six control subjects at rest and during a prescribed rhythmic exercise throughout a 13-week training and detraining program. The swimmers' mean exercise forearm blood flow increased progressively during the training program, reaching a maximum at the peak of training toward the end of the 5th week, after which it decreased to near post-training levels during the period of detraining. There was no significant change in the swimmers' resting blood flow; nor were there significant changes in either the exercise or the resting blood flows of the control group. (From the authors' abstract)

1525
Romanowski, W.,
and L. Lubańska-Tomaszewska
[THE MECHANISM OF THE CHANGES IN SERUM PROTEIN LEVELS DUE TO PHYSICAL TRAINING]
Mechanizm zmian obrazu elektroforetycznego białek surowicy krwi pod wpływem treningu fizycznego. —Acta physiologica polonica (Warszawa), 13 (6): 741-754. 1962. In Polish, with English summary (p. 753).

In a group of rats subjected to physical training changes were recorded in serum protein levels as compared to a control group. The total protein level, albumin content, and alpha$_2$-globulin fraction decreased. Both the beta-globulin and gamma-globulin fractions rose. The morphological picture of the peripheral blood revealed a fall in the red cell count and increases in the leukocyte and lymphocyte counts. Organ weight was increased for liver, spleen, and adrenals. Histological study of the experimental group revealed in the liver parenchymatous obfuscation and fine-drop fatty degeneration of cells; in the spleen more numerous plasma cells concentrated under the capsule, in the red pulp, and around the nodules; and in the adrenals hypertrophy of the cortex, particularly the zona fasciculata and zona reticularis.

1526
Ross, J. C.,
R. W. Reinhart, J. F. Boxell, and L. H. King
RELATIONSHIP OF INCREASED BREATH-HOLDING DIFFUSING CAPACITY TO VENTILATION IN EXERCISE.—Jour. Applied Physiol., 18 (4): 794-797. July 1963.

Breath-holding pulmonary diffusing capacity (DL) was measured in five subjects. All of the five subjects had an increase in DL during exercise when ventilation was voluntarily restrained to the resting level, and the mean increase was as great as the mean increase during the same amount of exercise with normal unrestricted breathing. The increase in DL, when breathing was restricted during exercise, could not be accounted for by differences in alveolar volumes or by differences in alveolar oxygen and carbon dioxide tensions in the two situations. This study demonstrates that increase in ventilation preceding the measurement is not a determinant of the increase in breath-holding DL with exercise. (Authors' abstract, modified)

1527
Royce, J.
OXYGEN CONSUMPTION DURING SUBMAXIMAL EXERCISES OF EQUAL INTENSITY AND DIFFERENT DURATION.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (4): 218-221. 1962. In English.

Twenty-six young male subjects performed work on a bicycle ergometer at a rate of 640 mkg./min. There were two tests per subject; one used a five-minute work period and the other a ten-minute work period. Oxygen uptake curves were obtained during the work and for seven minutes of recovery. Statistical analysis showed that no true steady state was reached even at this relatively low level of work. The deficit part of the average O_2 uptake curve was an almost exact mirror image of the repayment curve. The correlation between the individual deficit and pay-off values of oxygen uptake was found to be significant. (Author's summary)

1528
Royce, J.
OXYGEN INTAKE CURVES REFLECTING CIRCULATORY FACTORS IN STATIC WORK.—Internationale Zeitschrift für angewandte Physiologie (Berlin), 19 (4): 222-228. 1962. In English.

Oxygen consumption curves were obtained during static exercise on 34 young males. The workloads consisted of 70, 100, 130, and 160 lb. resistance.

At the onset as well as immediately after the termination of the work period, sudden changes of the normal (dynamic exercise) pattern of oxygen consumption were noted and explained in terms of circulatory factors. The linear increase in the "debt/income" ratio (oxygen intake during recovery over oxygen intake during work) with the increase in load shows that the circulation becomes increasingly impaired during static contraction. The metabolic cost of static work must be met by a relatively larger debt payoff during the recovery period. (Author's summary)

1529
Rusin, V. IA.
[NONSPECIFIC INCREASED RESISTANCE IN ANIMALS DURING MUSCULAR TRAINING AND TRAINING WITH SIMULTANEOUS ADMINISTRATION OF DIBAZOL] Sostoianie nespetsificheski povyshennoi soprotivliaemosti u zhivotnykh pri myshechnoi trenirovke i trenirovke s odnovremennym vvedeniem dibazola.—— Patologicheskaia fiziologiia i eksperimental'naia terapiia (Moskva), 6 (1): 49-53. Jan.-Feb. 1962. In Russian, with English summary (p. 53).

The process of muscular training (swimming) increases the resistance of white mice not only in respect to physical work but also to other environmental effects (low temperature, acceleration, the effects of alcohol on the central nervous system), i.e., there occurs a state of increased nonspecific resistance. Dibazol (2-benzylbenzimidazole hydrochloride) administered simultaneously with physical training intensifies the physiological shifts taking place during training, as shown by the earlier appearance and a more pronounced increase in body resistance. (Author's summary, modified)

1530
Russell, R. O.,
and T. J. Reeves
THE EFFECT OF DIGOXIN IN NORMAL MAN ON THE CARDIORESPIRATORY RESPONSE TO SEVERE EFFORT.—Amer. Heart Jour., 66 (3): 381-388. Sept. 1963.

Ten normal males 20-39 years of age were studied during treadmill exercise at moderate to exhausting levels of work. The maximal oxygen uptake, pulmonary ventilation, and heart rate compared well with peak levels found in the literature for subjects of similar age, habits, and weight. Digoxin administered in therapeutic doses had no measurable effect on oxygen uptake, pulmonary ventilation, or heart rate at any level of work, up to and including the maximum tolerated by each subject. (Authors' summary, modified) (29 references)

1531
Salminen, S.,
and A. Konttinen
EFFECT OF EXERCISE ON Na AND K CONCENTRATIONS IN HUMAN SALIVA AND SERUM.—Jour. Applied Physiol., 18 (4): 812-814. July 1963.

The effect of exercise on the salivary Na, K, and protein concentrations and on the serum Na and K concentrations was studied in young men. The exercise consisted of a march of two hours duration. The exercise had no marked effect on the serum Na and K. The salivary Na concentration increased nearly twofold during exercise, and had decreased to its initial value within two hours recovery. No noteworthy changes in the salivary K concentration occurred during the experiment. The salivary protein concentration increased during exercise, and this increase was positively correlated with the increase in the salivary Na/K ratio in the same man. These results are ascribed to the increased permeability of the plasma-saliva barrier during the exercise. (Authors' abstract)

1532
Sarajas, H. S. S.,
M. H. Frick, and A. Konttinen
LEUKOCYTOSIS UPON MUSCULAR EXERTION AND CONCURRENT CIRCULATORY CHANGES. —— Annales medicinae internae Fenniae (Helsinki), 51 (2): 81-86. 1962. In English.

Tests were performed on eight healthy recruits in a supine position subjected to mild muscular exercise for six minutes using a bicycle ergometer. The work load imposed resulted in an increase in cardiac output by 63-223%. With increasing cardiac output the mean circulation time decreased suggesting an increased circulation velocity. The leukocyte counts at rest varied from 5,200 to 10,100/cu. mm., and after exercise from 7,100 to 12,900/cu. mm. These results indicate that leukocytosis accompanying muscular exercise is occasioned mainly by concomitant circulatory activation releasing immobilized leukocytes from peripheral vascular compartments, especially from the pulmonary vascular bed. This same mechanism is suggested to operate in the establishment of other physiological leukocytoses, and even in pathological leukocytoses.

1533
Selivanova, V. M.
[THE EFFECT OF INCREASED PHYSICAL EXERTION ON THE LEVEL OF ASCORBIC ACID PASSED WITH THE MORNING URINE BEFORE EATING] Izuchenie vliianiia povyshennoi fizicheskoi nagruzki na uroven' vydeleniia askorbinovoi kisloty s utrennei mochoi natoshcak.—Voprosy pitaniia (Moskva), 22 (1): 75-77. Jan.-Feb. 1963. In Russian, with English summary (p. 77).

In 30 construction workers, ascorbic acid concentration in the urine was about 0.2 mg. per hour, at a daily expenditure of 3767 cal. and a vitamin C intake of 11 mg. An increase of the vitamin dosage to 59 mg. per day for 32 days caused a rise in the secretion level up to not more than 0.3 mg. per hour and up to 0.6 mg. per hour when the dosage was 107 mg. Vitamin C secretion levels remained the same in the control group at a daily energy expenditure of 3186 cal.

1534
Shabunin, R. O.
[THE DYNAMICS OF THE COURSE OF THE VASCULAR UNCONDITIONED REFLEX TO COLD IN MAN DURING TRAINING WITH STATIC MUSCULAR EXERCISES] Dynamika perebihu sudynnoho bezumovnoho kholodovoho refleksu u liudyny v protsesi trenuvanyia do statychnykh m'iazoykh napruzhen'.—Fiziologichnyi zhurnal (Kyiv), 9 (4): 451-457. July-Aug. 1963. In Ukrainian, with English summary (p. 457).

The endurance of static muscular stress was considerably increased in all subjects after 5-8 weeks of systematic exercises, consisting of holding of various loads on the shoulders. Symptoms of fatigue were delayed in trained subjects. Before the training commenced, the vasomotor reflex to cold was frequently inhibited, i.e., depressed or even reversed, during static muscular effort. After training the vasomotor reflex to cold was intensified and prolonged during the standard exercise. It is concluded that systematic training with static exercises improves the work of the vasomotor center during muscular exercise.

1535
Skriabin, V. V.,
R. A. Shabunin, and S. N. Dobronravov
[FUNCTIONAL PECULIARITIES OF THE CARDIOVASCULAR SYSTEM DURING STATIC EXERTION] Osobennosti funktsii serdechno-sosudistoi sistemy pri staticheskikh usiliiakh.—Gigiena truda i professional'nye zabolevaniia (Moskva), 6 (1): 39-45. Jan. 1962. In Russian, with English summary (p. 45).

Human subjects were exposed to static stress such as holding loads in their hands and exerting pressure on a pedal. Pulse rates and stroke and minute volumes increased in all cases, while the electrocardiogram showed an increased R-R interval and P wave and decreased T-P and Q-T intervals and T wave. The atrioventricular and the intraventricular conduction speed changed very little, but the amplitude of the R wave frequently either decreased or increased. The blood vessels of arm and hand distended during the exercise and in some instances even before it. In some cases the vascular reaction was diphasic, i.e., the dilatation followed an initial contraction. The vascular cold reflex changed very little, while the heat reflex was either completely absent or consisted of vasoconstriction rather than vasodilatation.

1536
Starke, R. D.,
and R. G. Bartlett
OXYGEN CONSUMPTION IN NORMAL SUBJECTS PERFORMING THE MODIFIED HARVARD STEP TEST. — Naval School of Aviation Medicine, Pensacola, Fla. (Research Project no. MR005.13-7004, Subtask 5). Report no. 14, Feb. 28, 1962. ii+7 p.

By use of recently described new, simple technique, accurate measurements of oxygen consumption during seven graded stress loads on the Harvard Step Test are presented. Comparisons to the conventional Master's test for coronary reserve are presented. (Authors' abstract)

1537
Strømme, S.,
K. L. Andersen, and R. W. Elsner
METABOLIC AND THERMAL RESPONSES TO MUSCULAR EXERTION IN THE COLD.—Jour. Applied Physiol., 18 (4): 756-763. July 1963.

The metabolic and thermal responses to muscular exertion in the cold were studied in outdoor and indoor workers. The metabolic rate during exercise was the same in the cold as in a thermally neutral (warm) environment when workload was sufficiently high to prevent a fall in the rectal temperature. At lower levels of work the metabolic rate in the cold was higher than that in the warm. No significant differences in the work metabolism were found between the groups. When the resting subjects were exposed to the cold environment prior to the exercise, the skin temperature decreased. The rate of decrease diminished as exercise progressed, and at higher load of work the extra heat generated in the body was enough to rewarm the skin, even on the most peripheral parts. The rate of decrease of skin surface cooling during rest in the cold was found to be slower in the outdoor workers than in the indoor workers, and the onset of the rewarming occurred much quicker in the former. These differences in skin temperature between outdoor and indoor workers indicate an acclimation to cold affecting the vasomotor control of the skin circulation. The hypothesis is suggested that habituation to cold leads to a lower set point of the thermosensitive cells in the thermoregulating center, so that vasodilatation impulses are discharged at a lower temperature. (Authors' abstract)

1538
Sumiyoshi, Y.,
M. Shiraishi, H. Iwabuchi, T. Sato, S. Yamaguchi, J. Ono, and K. Yamakawa.
EXPERIMENTAL STUDY ON THE MECHANISM OF EXERCISE PROTEINURIA [Abstract].—Japan. Circulation Jour. (Kyoto), 26 (12): 998. Dec. 1962.

The appearance of proteinuria during exercise was studied on athletes and in ergometer loading tests. The most probable mechanism of this type of proteinuria is thought to be the reversible increase of protein filtration brought about by the ischemic changes of the glomerular capillaries. In order to confirm these observations a unilateral renal artery constriction was carried out [in animals]. Parallel to the degree of constriction proteinuria increased, and disappeared with the release of the constriction. Electrophoretic findings of this protein in the urine were similar to proteinuria during exercise in man, and clearance tests also showed changes comparable to those in man. (Authors' summary, modified)

1539
Ts'ao, C. H.,
F. R. Meyer, B. E. Epperson, and L. O. Holgersen
THE INFLUENCE OF TEMPERATURE ON RESPIRATION IN EXERCISING MEN [Abstract]. — Physiologist, 5 (3): 222. Aug. 1962.

Studies on exercising men were made consisting of four 10-minute periods of exercise followed by 5-minute recovery periods. Treadmill exercise was done at 3.5, 4.0, and 5.8 m.p.h. on a 9% grade at 25° and 40° C. The time required to accelerate ventilation during the exercise period was much shorter than corresponding elevations in body temperature. In the recovery period rectal temperature continued to rise, and the deceleration of ventilation was much more rapid than the temperature decline in the gastrocnemius muscle or femoral vein. In the cooler state during successive periods of exercise the steady states of ventilation tended to remain the same while deep body temperature tended to rise. Temperature appears to contribute little to the rapid respiratory responses to short periods of vigorous exercise. But in moderate, prolonged work a rise in body temperature produced by increased environmental temperature increased ventilation of men by 20 to 40% per degree centigrade rise in rectal temperature. (Authors' abstract, modified)

1540
Vacca, C.,
and L. Vacca
[EXPERIMENTAL VERIFICATION OF SOME INTERESTING FORMULAS BASED ON A NEW CONCEPT OF HUMORAL REGULATION OF RESPIRATION, USEFUL FOR THE EVALUATION OF PULMONARY VENTILATION AND CIRCULATORY MINUTE VOLUME DURING PHYSICAL WORK AND AS INDICES OF CARDIOVASCULAR FUNCTION]
Controllo sperimentale di alcune interessanti formule basate su un nuovo concetto della regolazione umorale del respiro, utili per la valutazione della ventilazione polmonare e del volume minuto circolante durante il lavoro muscolare, e como indici della funzione cardio-vascolare.—Rivista di medicina aeronautica e spaziale (Roma), 26 (2): 223-235. April-June 1963. In Italian, with English summary (p. 231-232).

A total of 195 subjects, 18-21 years of age, performed strenuous exercise on a bicycle ergometer, and the pulmonary ventilation (V) and cardiac output (Q) were tested using the following formula: $V = 1.1\ (36.4+3.47\ V_{O_2}) + 2.3\ (42.5+6.53\ V_{O_2}) - 135 \pm 10.1$ liters/minute. V_{O_2} was determined in the subjects at rest and at work on the ergometer for each minute. The results obtained indicated that the formula was valid especially in the steady state of work. Moreover, the statistical error ± 10.1 liters of experimental V, as related to the theoretical value during exercise, could be used as a suitable index for the evaluation of the cardio-respiratory efficiency of the subject, especially for evaluation of the bulbar respiratory center efficiency in fitting V to metabolic requirements of muscular work. The formula $Q = 7.1\ V_{O_2}+5.3\pm1.6$ liters/minute gave values falling into the physiological range for cardiac output at rest and during muscular work.

1541
Warner, H. R.,
W. S. Topham, and K. K. Nicholes
THE ROLE OF PERIPHERAL RESISTANCE IN CONTROLLING CARDIAC OUTPUT DURING EXERCISE [Abstract]. — Physiologist, 5 (3): 227. Aug. 1962.

Dogs were studied during exercise while their peripheral resistance was artificially controlled. With resistance controlled at a steady state, heart rate and cardiac output increased less than 10% during exercise at 4 m.p.h. at 10% grade, while with no artificial control and the same amount of exercise, heart rate and cardiac output doubled as resistance decreased to one-half the resting value. Thus, it appears that the decrease in peripheral resistance that occurs with exercise constitutes the major determinant of cardiac output. (Authors' abstract, modified)

1542
Weybrew, B. B.
ACCURACY OF TIME ESTIMATION AND MUSCULAR TENSION.—Perceptual and Motor Skills, 17 (1): 118. Aug. 1963.

Twenty men demonstrated their maximum dynamometer grip and estimated in minutes and/or seconds how long the grip had been maintained. A table is presented to show the mean percentage accuracy of the estimate of the 43-second time interval for each grip intensity. Ignoring direction of time estimation errors, accuracy varied inversely with dynamometer tension. With tension increments errors tended to be increasingly in a negative direction, i.e., toward underestimation of the time interval. It appears that muscle tension states affect the accuracy of estimate of short time intervals largely in the direction of reducing the perceived duration of the time span.

1543
Williams, C. G.,
G. A. G. Bredell, C. H. Wyndham, N. B. Strydom, J. F. Morrison, J. Peter, P. W. Fleming, and J. S. Ward
CIRCULATORY AND METABOLIC REACTIONS TO WORK IN HEAT. — Jour. Applied Physiol., 17 (4): 625-638. July 1962.

Oxygen consumptions were measured at various levels of work up to the individual's maximum. At submaximal work they were significantly lower in heat than in comfortable temperatures, but maximum oxygen intakes were not significantly different. In comfortable conditions cardiac output and the difference in arterio-venous oxygen saturation both contributed to rise in oxygen intake during submaximal work. At maximal effort increase in arteriovenous difference accounted for the ultimate rise in oxygen intake. Both heart rate and stroke volume contributed to increase in cardiac output up to 1.0 liters/min. oxygen intake; above this heart rate was the sole factor. In heat the major change in hemodynamics was an increase in heart rate with an associated fall in stroke volume. Neither cardiac output nor arteriovenous difference was significantly altered from comfortable conditions. "Excess" lactate occurred at significantly lower levels of work in heat than in comfortable conditions. Working muscles were therefore relatively more anoxic in heat at submaximal work, and this accounted for lower oxygen intakes. At maximal work the degree of anoxia was the same in both temperature conditions. (Authors' abstract)

1544
Wilmore, J. H.,
and S. M. Horvath
ALTERATIONS IN PERIPHERAL BLOOD FLOW CONSEQUENT TO MAXIMAL EXERCISE.—Amer. Heart Jour. 66 (3): 353-362. Sept. 1963.

Recovery patterns of blood flow were studied after an exhaustive maximal exercise on a bicycle ergometer at 1,500 kilogram-meters per minute under conditions of (a) unrestricted circulation, and (b) occluded circulation of the lower limbs. In addition, electrocardiograms were recorded before, during, and after exercise. Exercising with the circulation to the lower limbs occluded reduced the mean work capacity of each of the 6 subjects to 1/3 to 1/6 of his work capacity with unrestricted circulation. The mean maximum heart rates under both conditions were similar. The recovery of the heart rate after the exercise of shorter duration, when the circulation had been occluded, was much faster than after the longer exercise with unrestricted circulation. The mean blood flow recovery curves after both conditions of exercise indicated that (1) there was no statistical difference between the mean recovery rates after the two conditions, despite the time differential needed to reach the same level of fatigue, and (2) the recovery curves after both exercises were characterized by two distinctly different rates of recovery, which followed independent, exponentially linear equations. Although blood flow in the calf had returned to approximately its pre-exercise resting level by the completion of each experiment, the heart rates were still elevated 9 to 20 beats per minute above their pre-exercise level. (Authors' summary)

1545
Workman, J. M.,
and B. W. Armstrong
OXYGEN COST OF TREADMILL WALKING.—Jour. Applied Physiol., 18 (4): 798-803. July 1963.

The development is described of an equation to predict the energy cost of treadmill walking of adult males. Oxygen consumption during level walking is considered as the product: oxygen consumption per step × number of steps per minute. At any given speed within the domain of the variable, number of steps per minute is then found to be a reciprocal function of height, and oxygen consumption per step a function of body weight. Rearrangement of the mathematical expressions that describe these relationships permits the calculation of oxygen consumption of level walking as the product of two constants, P_W, a constant for the individual; and K_s, a constant for the speed. It is suggested that these constants may have other uses besides the prediction of oxygen consumption of level walking. Oxygen consumption of grade walking is considered as the excess of oxygen consumption over that observed walking on the level at the same speed. This should be, but apparently is not, simply related to body weight. In a test of its predicting power, the equation predicted the oxygen consumption of 84 treadmill walks of 44 subjects, with a correlation coefficient measured: predicted values, $r = +0.935$. (Authors' abstract)

1546
Wyndham, C. H.,
N. B. Strydom, J. F. Morrison, C. G. Williams,
G. Bredell, J. Peter, H. M. Cooke, and A. Joffe
THE INFLUENCE OF GROSS BODY WEIGHT ON OXYGEN CONSUMPTION AND ON PHYSICAL WORKING CAPACITY ON MANUAL LABOURERS.—Ergonomics (London), 6 (3): 275-286. July 1963.

A regression line relating oxygen consumption to rate of work was calculated on 88 men from pairs of oxygen consumption and work-rate measurements at four different levels of work. A regression line was also calculated for maximum oxygen intake against gross body weight for 338 men. From these regression lines it is possible to estimate the proportions of their maximum oxygen intakes a light and a heavy man would use in stepping on and off a 1-foot stool at 6, 12, and 24 times per minute. The slopes of the lines are such that both men would use similar proportions of their maximum oxygen intakes at each of the three rates of stepping; the percentages are 26%, 36%, and 55% respectively. The distribution of the gross body weights of the 338 men was used to calculate a body weight such that 95% of the men having weights above this value would have maximum oxygen intakes of 2.0 liters/minute and more and therefore be capable of a moderate rate of work. A gross body weight of 132 lb. is the estimate and 43% of the population lie above this weight. The 'tolerance' limits about the oxygen consumption/gross body weights regression line are relatively narrow indicating that gross body weight is the major determinant in oxygen consumption when men lift their body weights against gravity. The 'tolerance' limits to maximum oxygen intake against gross body weight are wide, which suggests that the proportion of body fat influences the maximum oxygen intake value at a given body weight. (Authors' abstract)

i. Fatigue

1547
Adams, J. A.,
J. M. Humes, and H. H. Stenson
MONITORING OF COMPLEX VISUAL DISPLAYS. III. EFFECTS OF REPEATED SESSIONS ON HUMAN VIGILANCE. — Human Factors, 4 (3): 149-157. June 1962.

A vigilance experiment was performed using a visual monitoring task with multiple stimulus sources. Under investigation were effects of repeated sessions on monitoring behavior. Nine 3-hour sessions were given on consecutive days. Following a longer 7-day interval, a 10th session was given. The main findings were a significant decrement in detection latency within each session, but no statistically reliable evidence for a between-sessions effect. Evidence was presented to suggest that the spatial configuration of stimulus sources was a factor for vigilance decrement because efficiency of the observing response decreased as a function of observation time. (Authors' summary)

1548
Belágyi, J.,
and J. S. Felker
MUSCLE FATIGUE AND THE CRYSTALLIZATION OF MYOSIN.—Acta physiologica Academiae scientiarum hungaricae (Budapest), 21 (3-4): 327-330. 1962. In English.

The fatigability of the frog gastrocnemius was studied in the isolated and in situ muscle. When fatigue was the result of exertion of force, the muscle was immediately able to contract and perform a long series of contractions, if the load on the muscle was removed. This phenomenon indicates that muscle protein (myosin) crystallizes in response to tension. This may be of significance in various muscular activities, such as sports. (Authors' summary, modified)

1549
Bugard, P.
[PSYCHOSOMATIC ASPECTS OF FATIGUE IN FLYING PERSONNEL IN COMMERCIAL AVIATION] Aspects psychosomatiques de la fatigue du personnel volant de l'aviation commerciale.—Revue de méde-

cine aéronautique (Paris), 2 (5): 22-24. Nov.-Dec. 1962. In French.

Fatigue in flying personnel may arise from minor pathologies which escape ordinary medical examination. By correlating neuromuscular excitability and 17-ketosteroid elimination, it was determined that (1) a flight of long duration was fatiguing; (2) jet flying increased nervous fatigue more than conventional airplane flying; and (3) not enough time elapsed between jet flights. Because of the effects of endocrine glands on metabolism, some cases of fatigue were helped by hormone administration, such as 17-ketosteroids.

1550
Byck, R.,
and E. Hearst
ADJUSTMENT OF MONKEYS TO FIVE CONTINUOUS DAYS OF WORK. —— Science (Washington), 138 (3536): 43-44. Oct. 5, 1962.

The efficiency of well-trained monkeys improved after repeated exposures to a prolonged lever-pressing task. This result suggests that resistance to fatigue may be increased by prior experience with the fatiguing situation. (Authors' abstract, modified)

1551
Clarke, D. H.
STRENGTH RECOVERY FROM STATIC AND DYNAMIC MUSCULAR FATIGUE. —— Research Quarterly, 33 (3): 349-355. Oct. 1962.

Thirty university students were each given two types of local fatiguing exercise utilizing a spring-loaded hand ergograph. Six minutes of dynamic contractions at the rate of 30 per minute caused strength to decline from an initial value of 45.7 kg. to a steady-state value of 27.6 kg. The half-time (rate of decline) was 89 seconds. The corresponding figures for two minutes of continuous static exercise were 46.9 kg., 15.8 kg., and 38 seconds. Mathematical analysis of these fatigue curves confirmed the results of others. The progress of recovery was observed for 10 minutes. A two-component exponential equation accounted for the observed progressive return of strength. However, the rate parameters were quite different in the two curves; recovery was much faster and followed a different pattern after static exercise. (Author's abstract)

1552
Collins, J. B.,
and B. Pruen
PERCEPTION TIME AND VISUAL FATIGUE. —— Ergonomics (London), 5 (4): 533-538. Oct. 1962.

An experiment is reported on the times taken to perceive accurately two Landolt rings under conditions requiring a change of accommodation from a far to a near distance, to determine whether there is any increase in this time after performing a prolonged visual task. This experiment was part of a study of methods of measuring visual fatigue. Measurements were made on eight students before and after two-hour periods of setting a vernier gauge under two different levels of illumination (1 lumen/foot^2 and 30 lumen/foot^2). There was a significant increase in average time required if the two levels of illumination were considered together. Change of time required did not differ significantly between the two different levels of illumination of the vernier gauge during setting. Contrary to certain previous work, no average rise in variance of the settings of the vernier gauge was found during the two-hour periods over which the task was continued. (Authors' abstract)

1553
Formánek, J.
R. Fischer, and D. Frantíková
FLICKER FUSION FREQUENCY AND ELECTROENCEPHALOGRAPHY AS AN INDEX OF WORK LOAD TO THE CENTRAL NERVOUS SYSTEM.— In: International Congress of Physiological Sciences, 22 (Leiden, 1962), Proceedings, vol. 2, no. 1105, Amsterdam [1962].

Flicker fusion frequency was measured in operators at a short-wave transmitter by Hyška's apparatus and was compared with the results of a previous study on telephone operators. The mean effect of $\underline{p}$ (number of hours of work preceding the fusion frequency measurement) and $\underline{h}$ (hour of the day when measured) can be expressed by the equations: $f = f_o - 0.054h - 0.095p$ in men operators at the transmitter, $f = f_o - 0.048h - 0.053p$ in women operators at the transmitter, $f = f_o - 0.051h - 0.054p$ in women telephone operators, where f = observed mean fusion frequency (cycles/second) and f_o = basic fusion frequency. Thus, the mean effect of the duration of work was the same in women at the transmitter, where a small amount of information is processed by the central nervous system, and in telephone operators, where a very large amount of information is processed. One of the possible reasons for this could be the effect of the electromagnetic field. Only certain nonspecific electroencephalographic changes were observed. (Authors' abstract)

1554
Gromakovskaia, M. M.,
and T. N. Dish
[THE EFFECT OF FATIGUE ON THE PERMEABILITY OF THE HEMATO-ENCEPHALIC BARRIER] Vliianie utomleniia na pronitsaemost' gemato-encefalicheskogo bar'era.—Doklady Akademii nauk SSSR (Moskva), 150 (5): 1171-1173. 1963. In Russian.

Thirty minutes before being sacrificed fatigued rats received intravenous injections of CuI^{131}. The ratio of radioactivity of the blood to that of the brain was 5.5 in the test animals, while in unfatigued controls it amounted to 2.7. Additional experiments showed that intraabdominal injection of 0.2 ml. of 10% fuchsin solution into fatigued mice caused an onset of convulsions in 30 out of 40 test animals, and in 7 out of 40 controls. Similarly, intracranial injection of blood serum in cats resulted in an increased pressor reaction if the serum was obtained from nonfatigued animals and in an inhibition of the pressor reaction and strengthening of the depressor reaction if the serum donor had been fatigued.

1555
Lowenstein, O.
R. Feinberg, and I. E. Loewenfeld
PUPILLARY MOVEMENTS DURING ACUTE AND CHRONIC FATIGUE: A NEW TEST FOR THE OBJECTIVE EVALUATION OF TIREDNESS.—Investigative Ophthalmol. 2 (2): 138-157. April 1963.

Spontaneous pupillary movements in darkness were recorded (1) in healthy subjects of different ages when they were rested or fatigued, (2) in chronically tired subjects without known neurological defects, and (3) in patients with various neurological lesions. In some experiments, local or systemic drugs were used. While the pupils are large and quiet in darkness when the subject is alert, they oscillate under the influence of tiredness. Waves of spontaneous pupillary contraction and dilatation accompany periods of increasing sleepiness and spontaneous arousal until, at the moment immediately preceding sleep, the pupils become very small. The mechanism of these movements was analyzed and a simple test described which allows the objective determination of the degree of acute fatigue in a given subject at a given time. In the light of these results, the concepts of "normal" and of "pathologic" fatigue are discussed. (Authors' abstract)

1556
Luby, E. D.
J. L. Grisell, C. E. Frohman, H. Lees, B. D. Cohen, and J. S. Gottlieb
BIOCHEMICAL, PSYCHOLOGICAL, AND BEHAVIORAL RESPONSES TO SLEEP DEPRIVATION. — Annals New York Acad. Sci., 96 (1): 71-79. Jan. 13, 1962.

Twelve volunteer males were subjected to 123 hours of sleep deprivation in a ward setting. Eight subjects were studied individually, four were studied as a group. Nonpunitive techniques excluding drugs were used to keep the subjects active. Blood samples were withdrawn and psychological tests administered before the experiment, during sleep deprivation days, and on the third day of recovery. Psychopathological changes observed were hallucinations, delusions, and more or less pronounced paranoid thought processes. The pathology was more severe in the group situation. Decrements on the psychological tests became marked with progressive sleep loss. The mean level of adenosine triphosphate increased up to the 48th hour of sleep loss and then decreased rapidly below the basal level around the 96th hour. Similarly, the levels of adenosine diphosphate and adenylic acid dropped to approximately half the initial values around the 96th hour of sleep loss. Succinic oxidase was inhibited by serum from five subjects after 120 hrs. of sleep deprivation. Several hypotheses are proposed concerning the relationship between the impairment of energy-transfer and restorative systems in the brain, diminishing central sympathetic responsiveness, and pathological manifestations in sleep deprivation.

1557
Mirsky, A. F.,
and P. V. Cardon
A COMPARISON OF THE BEHAVIORAL AND PHYSIOLOGICAL CHANGES ACCOMPANYING SLEEP DEPRIVATION AND CHLORPROMAZINE ADMINISTRATION IN MAN. — Electroencephalography and Clinical Neurophysiol. (Amsterdam), 14 (1): 1-10. Feb. 1962.

Eight normal subjects were studied under control conditions, after 66-70 hours of sleep deprivation, and after administration of 200 mg. of chlorpromazine. Simultaneous recordings were made of behavior on a test of attention, electroencephalogram, respiration, and finger plethysmograph under all conditions. Both sleep deprivation and chlorpromazine produced marked impairment in the performance of the attention test. Errors in performance in the sleep deprivation condition were accompanied by slowing of the EEG, increased respiratory cycle length, and increased finger pulse amplitude as compared with periods when the subjects were performing correctly. Such differences in the physiological accompaniments of performance were far less marked in the chlorpromazine condition. Of the three physiological measures, the EEG appeared to be least accurate in reflecting variations in alertness. The significance of these findings is discussed in relation to the possible existence of separate, although closely related, mechanisms within the reticular activating system which mediate behavior on the one hand, and the EEG, respiration, and peripheral vasomotor tone on the other. (Authors' summary)

1558
Pierson, W. R.
FATIGUE, WORK DECREMENT, AND ENDURANCE IN A SIMPLE REPETITIVE TASK.—Brit. Jour. Med. Psychol. (London), 36 (3): 279-282. 1963.

Twenty-six male subjects were measured for reaction time and movement time under normal, fatigued, decrement, and endurance conditions during a simple repetitive stimulus-response task. For the population represented by the sample and under the conditions of the study, the following conclusions appear justified: (1) The subjective experience of fatigue is not a valid criterion of the ability to perform speed- or endurance-type muscular work. (2) Fatigue and endurance cannot be measured by work decrement. (3) Fatigue, endurance, and work decrement are independent variables. (Author's summary)

1559
Webb, W. B.
SOME EFFECTS OF PROLONGED SLEEP DEPRIVATION ON THE HOODED RAT. — Jour. Compar. and Physiol. Psychol., 55 (5): 791-793. Oct. 1962.

Six hooded rats were kept continuously active for 27 days. They showed no decrease in sleep latency when given the opportunity to sleep. There was a significant depression of startle response and weight gain. Aggressive behavior appeared after a considerable period of sleep deprivation. (Author's summary)

1560
West, L. J.,
H. H. Janszen, B. K. Lester, and F. S. Cornelisoon
THE PSYCHOSIS OF SLEEP DEPRIVATION. — Annals New York Acad. Sci., 96 (1): 66-70. Jan. 13, 1962.

The development of psychopathological changes in sleep-deprived individuals proceeds in two phases: (1) a prodrome in the first 4-5 days of sleep loss, and (2) a psychosis becoming more obvious from the fifth night on. Prodromal symptoms

include progressive loss of the capacity for fine movements, followed by gross tremor, staring, and illusions particularly in the peripheral visual field; bodily sensations of tingling, ringing or humming in the ears, feeling of a "pressure band" around the head; decrements in performance of some tasks although emergencies and semiautomatic tasks are handled well, reduced vigilance; fleeting hallucinations occur; fatigue, drowsiness, disinterest, and withdrawal tendencies grow more intense. The diurnal rhythm becomes very marked — all symptoms are more intense at night. The psychotic phase resembles the clinical picture of reactive type paranoid schizophrenia by day, and that of toxic delirium at night. Recovery is rapid after 12 to 15 hours of sleep although traces of impairment may persist for more than a week afterwards.

1561
Wilkinson, R. T.
MUSCLE TENSION DURING MENTAL WORK UNDER SLEEP DEPRIVATION. — Jour. Exper. Psychol., 64 (6): 565-571. Dec. 1962.

Twelve subjects performed a 20-minute test of addition, once after normal sleep and once under 32-56 hours of sleep deprivation. Records of muscle tension (EMG) were taken from the inactive arm. The subjects who maintained performance best under the stress showed the greatest rise in EMG over normal levels. Knowledge of results disturbed this relationship. An independent measure of EMG taken under normal conditions predicted those subjects whose performance was impaired. Sleep deprivation may cause inefficiency even in subjects who maintain performance if their raised EMG reflects greater effort or energy expenditure; this may be the cost of maintaining normal levels of arousal and performance in face of the depressing influence of sleep deprivation per se. (Author's summary)

k. Mental Stress

1562
Arutiunov, G. A.,
I. I. Antuf'ev, A. I. Vorob'ev, M. I. Kuznetsov, Iu. F. Udalov, and A. G. Shibuneev
[THE EFFECT OF NERVOUS STRESS ON CERTAIN VITAMIN REQUIREMENTS IN MAN] Vliianie nervnogo napriazheniia na potrebnost' organizma v nekotorykh vitaminakh.—Voprosy pitaniia (Moskva), 21 (4): 3-10. July-Aug. 1962. In Russian, with English summary (p. 10).

A comparative study of vitamin requirements was carried out on pilots of piston- and jet-propelled aircraft. The jet pilots had less B_1 and B_2 vitamins excreted in their urine, and there was evidence that their vitamin metabolism was lower than that of the piston-aircraft pilots. Furthermore, the B_1, B_2, C, and 4-pyridoxic acid content in the urine of pilots during test flights was lower than during conventional flights. Retention of vitamins was highest during high-speed and altitude flights, while their metabolism was lowered. It is concluded that nervous and psychic stresses are factors determining increased vitamin requirements in flying personnel.

1563
Brod, J.,
Z. Hejl, and M. Ulrych
METABOLIC CHANGES IN THE FOREARM MUSCLE AND SKIN DURING EMOTIONAL MUSCULAR VASODILATATION.—Clinical Sci. (London), 25 (1): 1-10. Aug. 1963.

Fasting subjects performed mental arithmetic at a rate too rapid to cope with for ten minutes, thereby undergoing emotional stress. Oxygen and glucose consumption in the forearm during emotional hyperemia was compared with that occurring during hyperemia of a similar degree produced by active exercise of forearm muscles. In 6 out of 10 experiments, oxygen consumption increased lightly in forearm muscles during emotion. The emotional increase in blood flow was of higher degree so that the oxygen arteriovenous (a-v) difference decreased in almost all experiments during emotion. There was no significant change in glucose muscle consumption during emotion, which was unlike the metabolic changes occurring in the same muscles during active exercise which produced an increase in blood flow of similar degree as emotion. The oxygen consumption always rose to a greater extent than blood flow so that the oxygen a-v difference always increased, as did that of glucose consumption. Clearance of $K^{131}I$ injected into forearm muscles increased during exercise hyperemia but did not change during emotional hyperemia. It is concluded that the increase in muscle blood flow during emotion does not subserve an increase in metabolic demand as it does during exercise, and that it occurs as part of a hemodynamic reaction. (Authors' summary, modified)

1564
Lazarus, R. S.,
J. C. Speisman, and A. M. Mordkoff
THE RELATIONSHIP BETWEEN AUTONOMIC INDICATORS OF PSYCHOLOGICAL STRESS: HEART RATE AND SKIN CONDUCTANCE. — Psychosomatic Med., 25 (1): 19-30. Jan.-Feb. 1963.

A number of intra-individual (across occasions) correlational methods were explored in correlating responses of different autonomic nervous system indicators of psychological stress. Data were obtained and analyzed accordingly from an extensive study of the effects of a benign and a stressor motion picture. Continuous recordings of heart rate and skin conductance were made on 50 subjects throughout the viewing of the films. When intra-individual correlational methods were applied, substantial relationships were found between heart rate and skin conductance. A curvilinear correlational method also produced substantial relationships. In addition, the magnitude of the intra-individual correlations rose significantly from the benign control film to the stressor film. These findings demonstrate that, as has been suspected for a long time but never adequately demonstrated, different autonomic indicators of stress do indeed rise and fall together as the degree of stress waxes and wanes. This cannot be shown by inter-individual statistics, but requires the study, within subjects, of the changes in stress reactions over various stimulus conditions, or over time. On the basis of these findings psychological stress can be inferred from one or several autonomic or behavioral response variables. (Authors' summary, modified)

1565
Weybrew, B. B.
BEHAVIORAL ENERGETICS. I. A FACTOR ANALYTICAL STUDY OF INDIVIDUAL DIFFERENCES IN MODES OF ENERGY DISCHARGE RESULTING FROM EXPERIMENTALLY-INDUCED FRUSTRATION.—Naval Medical Research Lab., New London, Conn. (Research Project no. MR005.14-2100-3.07). Report no. 378, March 7, 1962. iv+29 p.

Forty submariner volunteers were exposed to two stress-inducing situations, a pacing task and a discrimination conflict task. Changes in electrodermal conductance (EDC) in response to stress, and recoverability following stress, were accepted as measures of internal energy mobilization and re-equilibration. Change in hand tremor during the pacing experiment was used as a measure of external energy mobilization. Discrimination time in the conflict experiment, simple reaction time, respiration rate, scores from a neurotic symptom inventory, and peer ratings with respect to five personality traits were also included in the 29-variable matrix. Factor analysis of the matrix resulted in five factors labeled, for the purpose of discussion: optimal somatopsychological adjustment; reduced excitation level; reduced vigilance; high excitation level and external energy mobilization. Favorable adjustment to stress of the kind induced in this experiment appears to be related to high internal mobilization (increase in EDC), and by absence of evidence of external change (hand tremor). Some initial steps in the construction of a theoretical model described in the language of behavioral energetics are also presented. (Author's abstract)

I. Isolation and Sensory Deprivation

1566
Arnhoff, F. N.,
and H. V. Leon
PERSONALITY FACTORS RELATED TO SUCCESS AND FAILURE IN SENSORY DEPRIVATION SUBJECTS. — Perceptual and Motor Skills, 16 (1): 46. Feb. 1963.

Cattell's 16 P-F test was administered to 15 subjects prior to undergoing 48 hours of sensory deprivation. The personality profiles of the successful subjects were compared with those of four unsuccessful subjects who withdrew from the experiment after 12 to 27 hours in the cubicle. Significant differences between both groups were obtained on Factor F (Surgency) and Factor L (Protension), however no clear trend was discernible. These findings can be regarded as suggestive only because of the small number of subjects.

1567
Arnhoff, F. N.,
H. V. Leon, and C. A. Brownfield
SENSORY DEPRIVATION: ITS EFFECTS ON HUMAN LEARNING. — Science (Washington), 138 (3543): 899-900. Nov. 23, 1962.

The rote learning ability of human subjects under conditions of sensory deprivation for 48 hours was compared with results for a control group. The performance of the two groups was essentially the same. No significant facilitation or decrement in performance was noted, and in no instance were hallucinations, delusions, or other unusual phenomena reported. (Authors' abstract)

1568
Banks, R.,
and D. Cappon
EFFECT OF REDUCED SENSORY INPUT ON TIME PERCEPTION. — Perceptual and Motor Skills, 14 (1): 74. Feb. 1962.

All subjects (8) underestimated duration of reduced sensory input (actual duration, 1 1/2 hrs.) to a greater extent than the duration of the control interval. However, comparison of subjective feelings of time passage and the time estimate of the period of reduced sensory input for 15 subjects showed a lack of relationship.

1569
Burns, N. M.,
and D. Kimura
ISOLATION AND SENSORY DEPRIVATION.—In: Unusual environments and human behavior, p. 167-192. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

The psychological and physiological changes following the deprivation of normal environmental stimulation and social interactions are discussed. These changes include hallucinations, disorientation in space and time, metabolic alterations, and modifications of many physiological functions. Ameliorative measures, such as the programming of meaningful tasks and adequate communications, are suggested; but the need for long-term studies in this area is emphasized. As many of the contemplated missions involve crew complements of more than one man, the area of group cohesiveness and team effectiveness under stress assumes new importance. The psychological milieu must be regulated in a manner similar to the external and internal environments in order to combat the behavioral entropic increase in closed-loop systems. (93 references)

1570
Cleveland, S.,
E. E. Reitman, and C. Bentinck
THERAPEUTIC EFFECTIVENESS OF SENSORY DEPRIVATION: EVALUATION OF EFFECTIVENESS.—Arch. General Psychiatry, 8 (5): 455-460. May 1963.

A group of 20 schizophrenic and 20 nonpsychotic hospitalized psychiatric patients were exposed to a period of sensory deprivation. Behavioral ratings were made and psychological tests administered prior to and following sensory deprivation in order to evaluate any resulting change in clinical condition or personality structure. A control group of 20 schizophrenics was evaluated in similar manner but without an intervening period of sensory deprivation. No consistent changes either in behavior or psychological test performance were observed following exposure to sensory deprivation. (Authors' summary)

1571
Cohen, S. I.,
A. J. Silverman, and B. M. Shmavonian
PSYCHOPHYSIOLOGICAL STUDIES IN ALTERED SENSORY ENVIRONMENTS.—Jour. Psychosomatic Research (Oxford), 6: 259-281. Oct./Dec. 1962.

Several groups of body- and field-oriented subjects were tested for two hours in a low sensory input experiment with a high degree of uncertainty produced by limiting the information about the nature or duration of the experiment. The experimental "environment" was expected to highlight perceptual mode differences determined by Rod and Frame and Draw-A-Person Tests. Subjects who were field-oriented showed in contrast to body-oriented subjects: (1) most intense psychological discomfort, (2) higher incidence of visual and auditory imagery, (3) more evidence of disorganization of thought, and (4) greater discomfort with body sensations. They also revealed: (a) lesser ability to discriminate somato-sensory cues, which was most pronounced after the 2-hour exposure, and (b) EEG and skin resistance evidence of a higher level of alerting during the experiment although both groups started at the same level of activity. Altering the internal state of the two groups by means of a sedative or stimulant changed their response pattern to the experimental environment. Subjects who received lysergic acid diethylamide prior to sensory deprivation exhibited similar responses to the field oriented subjects as compared to controls receiving a placebo. Possible neurohormonal and neurophysiological differences in addition to perceptual mode and personality differences in body- and field-oriented subjects are discussed. The possible application of the experimental results to clinical diagnostic and therapeutic problems as well as to perceptual mode and personality differences are discussed. The possible application of the results to clinical diagnostic and therapeutic problems as well as to selection and training problems in aerospace research are reviewed. Authors' summary, modified) (40 references)

1572
Cornwell, A. C.,
and S. K. Sharpless
ELECTROPHYSIOLOGICAL CHANGES IN THE RETINA FOLLOWING VISUAL DEPRIVATION [Abstract].—International Congress of Physiological Sciences, 22 (Leiden, 1962), Proceedings, vol. 2, no. 979. Amsterdam [1962?].

Adult cats were subjected to monocular visual deprivation for one week. Electroretinograms were recorded at the end of this period from both eyes during pentobarbital anesthesia. Prior to each testing session the cats were dark-adapted for three hours and the pupils maximally dilated. In all animals the presentation of 2/second light flashes resulted in a marked reduction of the b-wave in the deprived eye. The difference between deprived and non-deprived eye was statistically highly significant at each of the five intensities tested. In the deprived eye moderate intensities of ambient illumination were relatively more effective in depressing the b-wave, and a longer time was required for dark adaptation after a brief exposure to light. Rapid, repetitive light flashes enhanced the difference between the two eyes. These changes persisted for periods up to four days. After one week of normal visual experience the differences between deprived and non-deprived eye disappeared. These results are discussed in terms of two hypotheses: (1) that neural elements deprived of stimulation become supersensitive and (2) that periodic exposure to light is essential for maintaining the normal photochemical composition of the retina. (Authors' abstract)

1573
Cramer, E. H.,
and D. E. Flinn
PHYCHIATRIC ASPECTS OF THE SAM TWO-MAN SPACE CABIN SIMULATOR.—School of Aerospace Medicine. Aerospace Medical Division, Brooks Air Force Base, Tex. (Task no. 775504). Technical Documentary Report no. SAM-TDR-63-27, Sept. 1963. iii+15 p.

Psychiatric studies were made of crew interactions in a series of eight Two-Man Space Cabin Simulator experiments. Crew interaction was observed periodically over closed-circuit television and surveillance microphones. Other information was obtained from diaries and debriefings. Many situations and factors (e.g., confinement, isolation, and sensory deprivation), which have been forecast in the literature as having potential psychiatric significance, did not appear to be problems on these simulated flights. Other factors, however, such as work-rest schedules, boredom, and interpersonal relations, do appear as areas of potential concern on actual prolonged space flight. (Authors' abstract)

1574
Cunningham, C.
THE EFFECTS OF SENSORY IMPOVERISHMENT, CONFINEMENT, AND SLEEP DEPRIVATION.—
In: Space research and technology, p. 25-28. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

An attempt is made to describe the probable effects of confinement, sensory isolation and impoverishment, and sleep deprivation. The experimental evidence and the evidence of former prisoners indicate that there is a level of sensory deprivation below which the consequences may be psychologically serious. This level varies between individuals and would seem to depend upon a number of factors, principally whether or not the space explorer is required to adopt a passive role. If one is to avoid reducing him to a pathological condition, three weeks would seem to be the limit for a passenger in a passive role. Whatever his role is, the limits of tolerance may be raised by careful selection of personnel according to their established ability to withstand the conditions. It may also be raised further by familiarizing the selected individuals with both the environment in which they are to operate and their own psychological reactions to it. If the journey involves more than 24 hours, then the space traveler may have to be stimulated at a high level especially for the first two or three days, and it may be possible to train him to stay awake for a few weeks. (Author's conclusions)

1575
Deikman, A. J.
EXPERIMENTAL MEDITATION.—Jour. Nervous and Mental Disease, 136 (4): 329-343. April 1963.

Meditation exercises were carried out with eight unpaid subjects. Four of them performed for twelve sessions while four others were used as controls in brief meditation control sessions. Each exercise consisted of concentration on an object to the exclusion of artificially introduced structured auditory stimuli designed to distract. Most subjects reported the following phenomena: (1) perceptual changes relating to the object meditated upon involving hue, color, dimension, form, outline, and movement; (2) development of a personal attachment to the object; (3) modification of the state of consciousness; (4) increased ability to shut out distracting stimuli; and (5) a general feeling that the sessions were pleasurable and valuable. Certain phenomena which were apparently individual responses were also reported. Since the phenomena reported by the meditation subjects were in many respects similar to those reported during and immediately after sensory deprivation, the author compares and contrasts the dynamics operating in each of these techniques.

1576
Freedman, S. J.,
U. Grunebaum, F. A. Stare, and M. Greenblatt
IMAGERY IN SENSORY DEPRIVATION.—In: Hallucinations, p. 108-117. Ed. by Louis Jolyon West. New York: Grune & Stratton, 1962.

The production of imagery in sensory deprivation seems to be related to a homogeneous visual field regardless of the field's intensity. Restricted motility may be an important factor, but this was not demonstrated in the authors' research. Sensory deprivation imagery closely resembles hypnagogic (and hypnopompic) imagery in its formal characteristics, mode of appearance, and content. Subjects are more likely to report imagery during sensory deprivation if they have a history of hypnagogic imagery than if they have not. (From the authors' conclusions)

1577
Grissom, R. J.,
P. Suedfeld, and J. Vernon
MEMORY FOR VERBAL MATERIAL: EFFECTS OF SENSORY DEPRIVATION. — Science (Washington), 138 (3538): 429. Oct. 19, 1962.

Memory retention of a short verbal passage did not change significantly in subjects who were isolated in a dark and soundproof room for 24 hours between the immediate recall test and the terminal recall test. A significant decrease in performance was noted in the control subjects who went about their everyday activities during the 24-hour period after acquisition. (Authors' abstract)

1578
Gunderson, E. K. E.
EMOTIONAL SYMPTOMS IN EXTREMELY ISOLATED GROUPS.—Arch. General Psychiatry, 9 (4): 362-368. Oct. 1963.

This study was concerned with measurement of emotional reactions in several groups of scientists and Navy men who were exposed to prolonged isolation and confinement at scientific stations in Antarctica. The conditions of restricted stimulation and activity experienced in the Antarctic groups induced an increase in emotional and physical symptoms in the participants. Most marked and consistent changes were evidenced in items reflecting sleep disturbances, depression, and irritability. Wide individual differences in susceptibility were present, and possible group differences in symptom incidence were noted. Many of the symptoms reported would be expected to have a deleterious effect upon motivation and social adjustment. (Author's summary, modified)

1579
Hanna, T. D.,
N. M. Burns, and P. R. Tiller
OBJECTIVE MEASUREMENTS OF THE FATIGUING EFFECTS OF WEARING A FULL PRESSURE SUIT: BEHAVIORAL AND PHYSIOLOGICAL RESPONSES TO VARYING PERIODS OF SENSORY DEPRIVATION. — Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Subtask no. MR005.13-1006.6). Report no. NAEC-ACEL-490. Feb. 1, 1963. vi+45 p.

Six volunteer subjects were randomly exposed to 4, 8, 12, and 24 hours of reduced sensory stimulation as may occur in future space vehicles. Heart rate and plantar electrical skin conductance were monitored continuously during each session. Measures of time estimation, digit span, sentence completion, draw-a-person, and visually presented amorphous figures were obtained at the termination of each session along with control values. Under the limited conditions of the experiment and within the boundaries discussed in the report, it appears that (1) significant sources of variance may be attributed to personality differences among subjects, (2) length of deprivation is not an over-all dominant source of variance, and (3) certain response systems are more sensitive to deprivation than others. (Authors' abstract) (78 references)

1580
Henrichs, T.
THE EFFECTS OF BRIEF SENSORY REDUCTION ON OBJECTIVE TEST SCORES.—Jour. Clinical Psychol., 19 (2): 172-176. April 1963.

The effects of brief sensory reduction (SR) experiences on objective test scores (Minnesota Multiphase Personality Inventory, Brownfain's Self-Concept scales) were studied with 40 male volunteers. The SR experiences (up to 5 hours) employed in this study (absence of sound and light) seemed to have little permanent or significant effect on the psychological functioning of the subjects. Suggestibility was not appreciably increased under the present experimental conditions. The results suggest that further investigation involving changes in experimental parameters, e.g., longer periods of SR and/or changes in the verbal stimuli, may prove rewarding. (Author's summary, modified)

1581
Izosimov, G. V.,
and V. I. Miasnikov
[ELECTROENCEPHALOGRAPHIC STUDY OF THE FUNCTIONAL STATE OF THE CENTRAL NERVOUS SYSTEM IN MAN DURING EXTENDED ISOLATION] Elektroentsefalograficheskoe issledovanie funktsional'nogo sostoianiia tsentral'noi nervoi sistemy cheloveka, nakhodiashchegosia v usloviiakh dlitel'nogo odinochestva.—Iskusstvennye sputniki zemli (Moskva), 15: 120-123. 1963. In Russian.

Five men were confined in a sound- and lightproof chamber for periods of 10-15 days. Electroencephalograms with bipolar leads were taken during light stimulation at different intensities. The initial reaction to the light stimuli was an increase of the α-potential from 20-25 to 55-60 microvolts. Starting with the third day there was a general retardation of the response to stimulation, i.e., the reactions were elicited only 7 or 9 seconds after exposure. Beginning with the seventh day, the amplitude of the α-waves was approximately 18-30 microvolts.

1582
Jackson, C. W.,
and E. L. Kelly
INFLUENCE OF SUGGESTION AND SUBJECTS' PRIOR KNOWLEDGE IN RESEARCH ON SENSORY DEPRIVATION. —Science (Washington), 135 (3499): 211-212. Jan. 1962.

Fourteen male college students were subjected to one hour of sensory deprivation (lying on a couch in a dimly lit room while wearing translucent goggles, gloves, cardboard cuffs, and earphones with white noise piped in). The students were informed that previous subjects had reported peculiar cognitive and perceptual experiences. They were given placebo pills with the suggestion that they contained a hallucinogenic drug which facilitates the effects of sensory deprivation. They were assured that under these conditions unusual experiences are entirely normal. In subsequent interviews all subjects reported a wide variety of unusual experiences in the visual, auditory, somesthetic, emotional, and cognitive spheres. The number of categories of experiences reported by each varied between 10 and 25. These results raise certain questions in regard to the role of suggestion in producing unusual experiences reported in sensory deprivation experiments and attributed to sensory deprivation.

1583
Jackson, C. W.,
J. C. Pollard, and E. W. Kansky
THE APPLICATION OF FINDINGS FROM EXPERIMENTAL SENSORY DEPRIVATION TO CASES OF CLINICAL SENSORY DEPRIVATION. —Amer. Jour. Med. Sci., 243 (5): 558-563. May 1962.

A brief account of a typical experimental technique for studying normal human beings under sensory deprivation is given. Neurophysiological and psychoanalytic theories of the resultant experimental "hallucinations", "delusions", and the like are briefly described, followed by two case histories of clinical sensory deprivation. During hospitalization under markedly reduced external stimulation each of these cases reported vivid hallucinations and delusions, experiences which disappeared following a treatment program of increased stimulation. (Authors' summary, modified)

1584
Jackson, G. W.,
and J. C. Pollard
SENSORY DEPRIVATION AND SUGGESTION: A THEORETICAL APPROACH.—Behavioral Sci., 7 (3): 332-342. July 1962.

Several commonly accepted interpretations of sensory deprivation behavior are examined together with contradictory research data. All of these are found untenable. On the basis of the assembled evidence it seems that the three prevalent interpretations may not hold true for short-term deprivation experiments and may not even be true for long-term experiments, i.e., the reported effects are not due to disorganization within the individual nor are they due primarily to the manipulation of physical dimensions such as stimulus patterning, stimulus intensity, social isolation, etc. Instead, an explanation is offered which expresses the self-report phenomena elicited in short-term deprivation experiments in three general variables: (a) the subject's knowledge of what is the appropriate or "expected" behavior in this particular type of stressful situation; (b) the subject's motivations (particularly his anxieties) to experience and report these "appropriate" behaviors or to negate them; and (c) the use of continuous reporting or "free-associative" instructions. The extent to which each of these three variables is involved in the production of any of the deprivation phenomena is determined by the experimental situation and the individual himself. (50 references)

1585
Kanareff, V. T.,
and J. T. Lanzetta
EFFECTIVENESS OF A SOCIAL REINFORCEMENT IN ISOLATION AND IN CONJUNCTION WITH A CONFLICTING TASK REINFORCEMENT.—Psychological Reports, 12 (3): 883-897. June 1963.

The effects of two partial social reinforcement schedules on the level of imitation were examined both in isolation and in conjunction with a task reinforcement. The two social reinforcement schedules, a constant probability of a negative reinforcement for imitation and an increasing probability of a negative reinforcement for imitation, were incongruent with the task reinforcement schedule in which the probability of a positive reinforcement for imitation was 0.8. The subjects predicted whether a red or green light would be illuminated after being informed of the prediction allegedly made by a partner. For half the subjects the event to be predicted was actually seen, along with the presentation of a galvanic skin response (GSR) reading purportedly reflecting the emotional state of the partner, immediately after each prediction. Only the GSR readings were presented at that time for the remaining subjects, the events to be predicted supposedly occurring on a machine in another room. As predicted, a significantly higher level of imitation was obtained under a 0.8 task reinforcement for imitation than in the absence of task reinforcement. The expected generalization failed to occur, however. Another inexplicable finding was the incongruity between the subjects' behavior while performing the experimental task and their subsequent behavior in completing questionnaires. It was suggested that individual differences in social responsiveness, in part determined by personality variables, might account for the difficulties in controlling imitation and opposition with social reinforcers. (Authors' summary, modified)

1586
Kenna, J. C.
EFFECTS OF SENSORY DEPRIVATION. SENSORY DEPRIVATION PHENOMENA: CRITICAL REVIEW AND EXPLANATORY MODELS.—Proc. Royal Soc. Med. (London), 55 (12): 1005-1010. Dec. 1962.

The experimental research on sensory deprivation is reviewed on the basis of the three classes of variables used: (1) absolute reduction of quantity of input, (2) alteration of patterning of stimulation, and (3) monotony. The effects of sensory deprivation experiences reported in literature are summarized with respect to the occurrence of panic, fear, or anxiety; changes in the affective level; perceptual changes; effect on perceptual motor skill; evaluation of time; changes in the level of consciousness; level of attention; restlessness, and inability to concentrate; cognitive efficiency; problem solving and abstract thinking; body image disturbances; auditory, visual, tactile, kinaesthetic, gustatory, and olfactory imagery; sensitivity feelings; somatic complaints; temporal ordering of the isolation phenomena; the duration of the phenomena; therapeutic effects on schizophrenics; and theoretical explanations. It is concluded that at the best the research in this area is still exploratory in nature with more rigorous research needed to discriminate among the variables. (52 references)

1587
Leiderman, P. H.
IMAGERY AND SENSORY DEPRIVATION, AN EXPERIMENTAL STUDY. — Harvard Univ. Medical School, Boston, Mass. (Contract AF 33(616)-6110); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7220). Technical Documentary Report no. MRL-TDR-62-28, May 1962. vii+111 p.

The effect is evaluated of repeated exposure of the same individual to short periods of sensory deprivation and isolation. Behavioral and physiological responses were measured and their relationship to modification of visual input determined. The results suggest that physiological adaptation to isolation continues over several sessions. The presence of visual imagery in a subject appeared to be related to the individual personality, and not to the conditions of deprivation. Auditory and somesthetic imagery appeared to be related to the type of deprivation. Body movement response was negatively related to the amount of imagery. The findings point up the importance of non-imagery factors as measures of stress and the importance of assessing individual differences in imagery responses under conditions of isolation. (Author's abstract)(53 references)

1588
Levitt, E. E.,
J. P. Brady, D. R. Ottinger, and R. Hinesley
EFFECT OF SENSORY RESTRICTION ON HYPNOTIZABILITY: A CLINICAL STUDY. — Arch. General Psychiatry, 7 (5): 343-344. Nov. 1962.

Three subjects who had resisted a previous attempt at eyelid catalepsy following tape-recorded, 10-minute induction procedure in a group situation, were submitted to a four-hour limited sensory isolation. Then the recording of hypnotic induction was played once more concluding with the challenge of eyelid catalepsy reinforced by the hypnotist. Since all three subjects effectively resisted the challenge, it is suggested that the effect of sensory restriction on suggestibility or hypnotizability is a limited one.

1589
Levy, E. Z.
THE SUBJECT'S APPROACH: IMPORTANT FACTOR IN EXPERIMENTAL ISOLATION? — Bull. Menninger Clinic, 26 (1): 30-42. Jan. 1962.

Findings from sensory deprivation experiments are reviewed and discrepancies considered from the standpoint of the individual's approach to serving as a subject, and the extent to which his approach is affected by the experimental situation. Variables which have to be considered in addition to the experimental variables are the degree to which the subject agrees to participate, to be controlled, and to be observed; his trust toward the experimenter; his perception of the situation as friendly, unfriendly, or threatening; and his perception of the experimenter's attitudes. Ability to tolerate loss of control over the environment or have limited control only may determine subsequent behavior and emerging defenses. The author regards the subject's approach to be of central importance in the isolation experience and to be considered in the formulation of theories.

1590
Mannion, A.
SENSORY DEPRIVATION. — Main Currents in Modern Thought, 18 (4): 93. March-April 1962.

Sensory deprivation experiments stimulated by investigation of the "brain-washing" techniques have contributed towards better understanding of brain function, particularly the role of the reticular formation. Some of the more prominent disturbances in isolation include hallucinations which are clearly differentiated from reality, slowing of cortical activity on the electroencephalograph, and the appearance of an alpha rhythm which can be blocked not only by exogenous stimuli but also by hallucinations. The new insights gained about fantasy, hallucinations, and other effects of isolation have been applied in such diverse areas as depressions originating in immobilized clinical cases, therapy of mental patients, and "highway hypnosis".

1591
Miller, S. C.
EGO-AUTONOMY IN SENSORY DEPRIVATION, ISOLATION AND STRESS. — International Jour. Psycho-Analysis (London), 43 (1): 1-20. Jan.-Feb. 1962.

The author analyzes elements in common among sensory deprivation experiments, experiences of social isolation in imprisonment or stress, and clinical observations of certain ophthalmologic conditions. These common elements are discussed in terms of the autonomy of the ego, its maintenance, and its impairment. The maintenance of autonomy is associated with ego-activity and regression in the service of the ego, and the impairment of autonomy with ego passivity and regression proper.

After an analysis of several psychoanalytic theories, the concept of ego-autonomy is implemented to mean a capacity for self-government on one hand, and relative independence from stimulation of a non-demanding nature on the other hand. (151 references)

1592
Murphy, D. B.,
and T. I. Myers
OCCURRENCE, MEASUREMENT AND EXPERIMENTAL MANIPULATION OF VISUAL "HALLUCINATIONS". —Perceptual and Motor Skills, 15 (1): 47-54. Aug. 1962.

In this study the effects of prior verbalization and instructions upon reported visual sensation under minimal sensory deprivation conditions were evaluated. For the prior verbalization variable, 40 subjects were administered three cards from the Rorschach. An additional 40 subjects had no Rorschach pretest. Within each prior verbalization condition, half of the subjects received positive instructions ("it is normal to have visual sensations") and half received negative instructions ("psychiatric patients report visual sensations"). After 10 minutes of lying on a bed wearing opaque goggles, subject was asked to report for 15 minutes the visual sensations he was actually experiencing. The positive instruction groups reported significantly more frequent and more complex visual sensations than the negative groups. The prior verbalization treatment effect was not significant. The results indicate that for sustained sensory deprivation studies, a base line of reported visual sensations under minimal deprivation conditions should be established before visual experiences can be attributed solely to the effects of sustained sensory deprivation. (Authors' summary, modified)

1593
Myers, T. I.,
and D. B. Murphy
REPORTED VISUAL SENSATION DURING BRIEF EXPOSURE TO REDUCED SENSORY INPUT.— In: Hallucinations, p. 118-124. Ed. by Louis Jolyon West. New York: Grune & Stratton, 1962.

A total of 80 basic trainees were subjected to brief periods of isolation with limited sensory input. Prior to this experience half of the sample were administered the Rorschach cards VIII, IX, and X (Ror group). Both the Ror group and the Non-Ror group were divided into positive-expectation and negative-expectation subgroups. The results indicate that nonpsychiatric subjects isolated in the dark for ten minutes will experience a variety of visual sensations even under conditions of minimal deprivation. Instructions influenced the frequency and complexity of reported visual sensations. The degree of imagination on certain Rorschach cards had no significant relationship to the number or complexity of visual sensations.

1594
Ninow, E. H.
SUBMARINE PSYCHIATRY.—Arch. Environmental Health, 6 (5): 579-588. May 1963.

The major functions of a submarine psychiatrist are described, as well as the psychiatric services provided. The incidence of psychiatric illness in the submarine Service is low (20 per thousand). There is an indication that individuals with less than high school education, single individuals, and those with lower Naval ratings account for a higher proportion of psychiatric referrals. The most significant stressors affecting the quality of adjustment during protracted marine submergence are reviewed. The systemic effects of atmospheric contaminants accumulating during submergence, as well as the submariners' attitudes toward submarine air as a health hazard, seemed important. The relative lack of cognitive anchoring-points, such as day-night cues, may exert an adverse effect on the men's adjustment. (From the author's summary)

1595
Reed, G. F.
EFFECTS OF SENSORY DEPRIVATION: PREPARATORY SET AS A FACTOR IN THE PRODUCTION OF SENSORY DEPRIVATION PHENOMENA.—Proc. Roy. Soc. Med. (London), 55 (12): 1010-1014. Dec. 1962.

The following conclusions are drawn on the basis of the author's experiments: (1) With normal subjects it is possible to elicit, in less than 40 minutes, most of the sensory deprivation phenomena reported by investigators using many hours or days. (2) The types and degrees of experience reported by subjects are associated with expectations or set, as are the subjects' affective responses to the sensory deprivation situation. (3) Examination of data suggests that the phenomena are explicable in terms of known normal psychological mechanisms. (Author's summary, modified)

1596
Robertson, M. [H.]
and R. Browning
THE EFFECT OF BRIEF SENSORY DEPRIVATION UPON RESPONSES TO A WORD ASSOCIATION TEST.—Psychological Record, 13 (3): 259-264. July 1963.

Since in the absence of external stimulation an individual's behavior is influenced by the primary process, it was hypothesized that under sensory deprivation the subjects would make more deviant responses to projective test stimuli. Using Rapaport's Word Association Test, the responses of 20 college students exposed to three hours of sensory deprivation were compared to those of 20 non-deprived college subjects in terms of reaction time, popular associations, errors in recall, and reactions to traumatic words. The two groups did not differ significantly on any of the four criteria. It is possible that a longer period of sensory deprivation or a more drastic reduction of sensory input may produce data supporting the above hypothesis. However, the results of this study challenge the basic assumption that an increase in the primary process is manifested in a greater number of abnormal or deviant reactions to projective stimuli. (Authors' summary, modified)

1597
Robertson, M. H.,
and D. J. Wolter
THE EFFECT OF SENSORY DEPRIVATION UPON SCORES ON THE WECHSLER ADULT INTELLIGENCE SCALE.—Jour. Psychol., 56 (1): 213-218. July 1963.

Two groups of ten subjects each were administered the Wechsler Adult Intelligence Scale. Three weeks later, the WAIS was again administered. Prior to the second administration one group received three hours of social isolation and partial sensory deprivation. While both groups showed significant changes from the first to second administration of the test, differences between the groups were not significant. All changes were in the direction of higher scores upon the retest. (Authors' summary, modified)

1598
Rokotova, N. A.,
T. M. Kucherenko, V. N. Pavlov, and A. I. Trokhachev
[THE EFFECT OF SLEEP DEPRIVATION ON SOME ASPECTS OF HUMAN HIGHER NERVOUS ACTIVITY] Vliianie lisheniia sna na nekotorye storony vysshei nervnoi deiatel'nosti cheloveka.—Problemy kosmicheskoi biologii (Moskva), 2: 273-286. 1962. In Russian, with English summary (p. 286).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 283-296. March 27, 1962. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The higher functions of the adult human brain under sleep deprivation were studied by a method which allows the analysis of both determined and probabilistic types of learning. A group of four adult men were trained on both types of tasks, rigid complex stereotyped problems and stochastic model problems, to a criterion as measured by the amount of time needed for solution, the number of errors, and agreement of choices made with the programmed possibilities. Twenty-four hours of sleep deprivation resulted in a retardation of learning on the rigid-type programs and a breakdown of learning on the probabilistic type problems after a brief period of progress.

1599
Rokotova, N. A.,
I. D. Bogina, O. P. Bolotina, T. M. Kucherenko, E. S. Rogovenko, and R. L. Sheikin
[THE EFFECT OF PROLONGED LIMITATION OF MOTOR ACTIVITY ON THE ACTIVITY OF MONKEYS] Vliianie dlitel'nogo organicheniia dvigatel'noi aktivnosti na zhiznedeiatel'nost' obez'ian.—Problemy kosmicheskoi biologii (Moskva), 2: 417-427. 1962. In Russian, with English summary (p. 427).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 424-434. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 36-21437)

Day and night observations on the behavior rhythms of monkeys restricted and unrestricted in their activities show no essential changes in physiological functions and activity of the restrained monkeys. During the first 2 or 4 days of fixation decrease of sleep time, increase of motor activity, and depression of the orientation-investigation reflex were observed. From the third to fifth day a constant rhythm of diurnal activity was established with the time allocated to sleep exceeding the normal; the orienting reflex became more activated; the amount of food consumed was reduced by 26-50% with selection of food items unchanged. The body weight increased sharply during a restriction of 3.5 months. The general condition of the animals and the appearance of their hair and skin were good. Respiration was normal. It is concluded that long-term restriction of motor activity is not detrimental to the activity of monkeys. (From the authors' summary)

1600
Rosenblum, I.
LIGHT DEPRIVATION AS A MEANS OF LOWERING ELECTROSHOCK THRESHOLDS IN RABBITS.—Exper. Neurology, 8 (1): 30-34. July 1963.

Maximal electroshock seizure thresholds were determined in thirty-two rabbits exposed alternately to either continuous full illumination or continuous darkness. In most rabbits, continuous darkness caused a lowering of the individual electroshock thresholds. The seizure pattern was also changed during continuous darkness with an increase in the clonic phase and the postictal phase of the maximal seizure. The threshold-lowering effect of light deprivation may be related to decreased high energy phosphate metabolism during continuous darkness. (Author's summary)

1601
Rossi, A. M.,
J. B. Sturrock, and P. Solomon
SUGGESTION EFFECTS ON REPORTED IMAGERY IN SENSORY DEPRIVATION. —— Perceptual and Motor Skills, 16 (1): 39-45. Feb. 1963.

Eighteen subjects received the same standard series of imagery instructions under normal conditions, during hypnosis, during sensory deprivation, and after administration of a drug (placebo) in a counterbalanced order. At the outset each subject predicted which conditions would produce the most vivid imagery and which the least vivid imagery. At the end of each test the subjects completed a questionnaire dealing with the clarity and vividness of the experienced images. The subjects were hypnotized by the procedure outlined in the Stanford Hypnotic Scale which gives a rough index of the depth of hypnosis. Subjects were in sensory deprivation for one hour prior to receiving imagery instructions. The placebo was described to the subjects as a relaxant drug which enhances imagery production. The results were (1) an enhancement of imagery under the hypnosis condition not obtained under the other conditions; (2) no significant differences between the normal and the placebo conditions; (3) a significantly lower mean imagery score for the sensory deprivation condition; and (4) no significant relationship between the prediction and subsequent report of imagery. (Authors' summary, modified)

1602
Schwitzgebel, R.
A COMPARATIVE STUDY OF ZULU AND ENGLISH REACTIONS TO SENSORY DEPRIVATION.—International Jour. Social Psychiatry (London), 7 (3): 220-225. Summer 1962.

An experiment in sensory deprivation was conducted with two unsophisticated social groups--Zulus and English-speaking whites in Durban, South Africa. Both groups (10 subjects in each) were matched with respect to age, educational level, and proportion of sexes. The subjects were placed in a room under two conditions: (1) a combination of relatively non-patterened stimulation and a social isolation; and (2) social isolation only. A comparison of the Zulu and the English subjects' reactions after eight hours showed no difference in the number of occurrences of vivid imagery. However, Zulus under sensory deprivation showed significantly less variation in their ability to perform certain perceptual and cognitive tasks. Comparing the two conditions, a definite trend towards the production of more vivid imagery was found under Condition I but there was no evidence of more cognitive or perceptual fluctuations in task performance. The results support previous work indicating the ability of relatively short periods of "non-patterning" to produce vivid imagery and illusions. However, variability in perception and cognition appears to be considerably influenced be genetic and social factors. It is suggested that the effect of major cultural variables should be examined more closely before assuming that sensory deprivation necessarily determine the modifications commonly reported in Canadian and U. S. studies. (Author's summary, modified) (26 references)

1603
Shurley, J. T.
HALLUCINATIONS IN SENSORY DEPRIVATION AND SLEEP DEPRIVATION.—In: Hallucinations, p. 87-91. Ed. by Louis Jolyon West. New York: Grune & Stratton, 1962.

The scope of the panel on the relationship between hallucinations and the experimental methods of sensory deprivation and sleep deprivation is stated along with definitions of the terminology used, clarification of the experimental techniques, and relevant anecdotal and clinical observations. Some of the vivid hallucinatory experiences reported from sensory deprivation experiments are described. (36 references)

1604
Shurley, J. T.
MENTAL IMAGERY IN PROFOUND EXPERIMENTAL SENSORY ISOLATION.—In: Hallucinations, p. 153-157. Ed. by Louis Jolyon West. New York: Grune & Stratton, 1962.

Nine adult male and two adult female volunteers served as subjects in this study on the mental effects of extreme attenuation of all sensory input. Each subject was fitted with a head mask and instructed to remain motionless and fully immersed in a water tank until termination. None of the subjects endured this more than six hours. Every subject experienced some form of mental imagery ranging from daydreams to sleeping dreams, from illusions to hypnogogic hallucinations and even some fully projected hallucinatory experiences.

1605
Silverman, A. J.,
S. I. Cohen, B. Bressler, and B. M. Shmavonian
HALLUCINATIONS IN SENSORY DEPRIVATION.—In: Hallucinations, p. 125-134. Ed. by Louis Jolyon West. New York: Grune & Stratton, 1962.

Some of the variables contributing to dissimilar responses in a low sensory input environment were explored in a pilot study with male and female subjects. Their experiences during two hours in isolation in a dark sound-proof room were evaluated on the basis of three interviews and a questionnaire. Visual sensations reported were based to a great extent on an elaboration of phosphenes sometimes evoked deliberately by pressure on the eyes. In two cases an ambiguous cue provided by light leaking through was elaborated into illusions which could have been termed hallucinations if the exogenous cue were not recognized. Similarly the hum of the ventilator gave rise to complex ideas, percepts, and emotions on the auditory level. Kinesthetic distortions included changes in the consistency and texture of the walls, increase or decrease of the distance of walls and various references to the need for touching and softness. The relative distinction between illusion and hallucination is discussed in reference to the background of external and internal cues. It is felt that abrogation of ego function and confusion of body image that occur in an environment with decreased sensory input may have a neurophysiological correlate in the interactions between the afferent impulses to the reticular system and the limbic inflow.

1606
Siprelle, C. N.,
T. E. Long, and T. W. Lucik
QUALITATIVE CHANGES IN VERBAL RESPONSE AS A FUNCTION OF STIMULUS DEPRIVATION.—Jour. Clin. Psychol., 19 (3): 287-289. July 1963

Eight female volunteers were subjected to a 45-minute period of visual and auditory deprivation and then requested to elaborate a 5-minute long story. All verbal responses were tape-recorded. The subjects served as their own controls with 7 days elapsing between the sensory deprivation condition and no deprivation condition where the subjects merely elaborated a 5-minute story using the same basic characters. The verbal responses were scored as referring to the environment, the subject, or the examiner. Stimulus deprivation resulted in a shift toward more self-directed response and fewer environment-directed responses.

1607
Smith, S.
EFFECTS OF SENSORY DEPRIVATION: CLINICAL ASPECTS OF PERCEPTUAL ISOLATION.—Proc. Royal Soc. Med. (London), 55 (12): 1003-1005. Dec. 1962.

The effects of reduced perceptual and sensory stimulation are reviewed on the basis of several studies carried out with healthy volunteers, schizophrenics, and volunteers receiving a psychomimetic drug. All subjects underwent the isolation experience in a specially constructed suspended soundproof room. With most of the normal volunteers there was a clearcut chain of events: sleep, followed by a period of agitation and tension which culminated in a panic. Schizophrenics tolerated isolation extremely well; some improvement in cognition appeared on psychological tests. Electroencephalographic activity showed widespread slowing with conspicuous theta and delta rhythms up to one hour after deprivation. Sensory deprivation in combination with phencyclidine and lysergic acid seemed to prevent the psychological effects associated with these drugs. It is suggested that certain sensory inputs are needed for the development of the psychological phenomena usually found with these drugs.

1608
Solomon, P.,
and J. Mendelson
HALLUCINATIONS IN SENSORY DEPRIVATION.—In: Hallucinations, p. 135-145. Ed. by L. J. West. New York: Grune & Stratton, 1962.

Volunteers were subjected to sensory deprivation in a tank-type respirator. Seven of twenty-eight developed hallucinations. All seven had visual hallucinations, three also had somesthetic hallucinations, none had auditory hallucinations. The visual hallucinations were vivid, largely three-dimensional, upright with respect to gravity, and usually in brilliant color. In three instances the content of the hallucinatory material appeared to be related to data obtained from psychiatric interviews with the subject. Comparison of the hallucinating (H) group and non-hallucinating (non-H) group revealed no differences with respect to motivation for volunteering, personality characteristics, length of stay, amount of motor activity, amount of verbalization, duration of sleep, number of references to somatic complaints per hour, estimation of time elapsed, and reasons for leaving the experiment. In the experiments in which urinary catechol amine excretion was measured, the non-H group had a larger increase in noradrenalin excretion than the H group, and a larger increase in urine volume output. The H group experienced fewer daydreams and more illusions and pseudosomatic delusions than the non-H group. These data are discussed in terms of current concepts of hallucinations and the criteria for their definition. (Authors' summary)

1609
Strollo, M.
[RESEARCH ON THE BEHAVIOR AND PERSONALITY OF CONFINED SUBJECTS] Ricerche sul comportamento e sulla personalità in soggetti sottoposti a confinamento. —— Rivista di medicina aeronautica e spaziale (Roma), 25 (3): 530-548. July-Sept. 1962. In Italian, with English summary (p. 545-546).

Seventy normal men between 20-25 years of age, of different social, economic, and cultural levels were confined to an isolation chamber for 6 hours. Subjects were kept in a state of constant vigil (no smoking, reading, sleeping, etc.) throughout the test. Studies were made of the (1) degree of tolerance to confinement; (2) values for perceptive-motor efficiency before and after the experiment; (3) behavior; and (4) possible interrelation between tolerance and personality as ascertained through clinical methods and personality tests. The results indicated a relationship between tolerance to confinement and some dominant personality traits. Especially important were instinctive-affective and practical-volitional behavior, aspects not strictly related to the mental and cultural background. These data may be of great value in the preliminary evaluation of the prerequisites necessary for the selection of astronauts.

1610
Strollo, M.
[STUDIES ON SUBJECTIVE TIME ESTIMATION DURING CONFINEMENT TESTS OF LIMITED DURATION UP TO SIX HOURS] Ricerche sull' apprezzamento soggettivo del "tempo" durante prove di confinamento di durata limitata al massimo di sei ore.—Rivista di medicina aeronautica e spaziale (Roma), 26 (2): 256-262. April-June 1963. In Italian, with English summary (p. 261).

It has been generally assumed that subjective time estimation depends on emotional factors linked with the activity of the subject. Thus time appears shorter when one is engaged in an absorbing task. The author studied the effect of confinement (with considerable perceptual and motor deprivation) on time estimation in a group of 70 subjects of different social, economic, and cultural background. The duration of the confinement was underestimated by 52 (74%) and overestimated by 18 subjects (26%), the mean of the estimates being 30% below the actual time of confinement.

1611
Tranel, N.
EFFECTS OF PERCEPTUAL ISOLATION ON INTROVERTS AND EXTRAVERTS.—Jour. Psychiat. Research (Oxford), 1 (3): 185-192. Dec. 1962.

Twenty extraverts and twenty introverts were selected from a larger group of subjects on the basis of their scores falling 1.5 standard deviations from the mean on the Myer-Briggs Type Indicator. The subjects of each group were exposed up to four hours to perceptual isolation in a sound-treated room with white noise fed into their ears, halved ping-pong balls in front of their eyes, and rubber gloves and cuffs. The reactions of introverts were characterized by close adherence to instructions, stimulus-bound thought processes, and termination of isolation before their four hours were up. Reactions of extraverts were characterized by a tendency to violation of instructions, thoughts of pleasant reverie, sleep, moving about while awake, and enduring isolation for the specified time. Perceptual changes such as hallucinations, delusions, and fantasy, usually reported in isolation studies, failed to occur.

1612
Vernon, J. A.,
and T. E. McGill
SENSORY DEPRIVATION AND HALLUCINATIONS.—In: Hallucinations, p. 146-152. Ed. by Louis Jolyon West. New York: Grune & Stratton, 1962.

The occurrence of hallucinations is described in a sensory deprivation experiment employing a basic arrangement in which the subject wears arm gauntlets and is lying down on a bed in a dark soundproof room. In Phase I (72 hours) the confinement was interrupted three times a day for meals and toilet needs in dim illumination; in Phase II (96 hours) the meals and toilet facilities were self-regulated in complete darkness. Occurrence of hallucinations was determined in a standardized post confinement interview. As the conditions of sensory deprivation were made more severe, the number of hallucinations dropped off drastically. Apparently both patterned vision and no vision prevent hallucinations under the conditions of sensory deprivation. Light stimulation which does not allow either pattern or form discrimination does produce hallucinations. The longer the confinement, the more likely the production of hallucinations.

1613
Vernon, J. A.,
and T. E. McGill
TIME ESTIMATIONS DURING SENSORY DEPRIVATION.—Jour. General Psychol., 69 (1): 11-18. July 1963.

As a test of the time-sense hypothesis of MacLeod and Roff 33 human subjects were confined for periods ranging from eight hours to 96 hours under conditions described as "sensory deprivation". Twenty-seven of these subjects simply gave estimates of how long they had been in confinement at release. The remaining six subjects were each confined for 96 hours and a cumulative record was kept of their time estimates. The major findings were: (1) a strong tendency to underestimate time spent in sensory deprivation, and (2) a great variability in time sense from subject to subject. The results do not support the hypothesis of an intersensorial and/or partially presensorial time sense. (Authors' summary, modified)

1614
Weybrew, B. B.
PSYCHOLOGICAL PROBLEMS OF PROLONGED MARINE SUBMERGENCE.—In: Unusual environments and human behavior, p. 87-125. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

A summary is given of the many biological, psychological, and engineering factors involved in maintaining viable a small society of men living in the closed ecological system contained within the hull of a nuclear submarine. The problems of interpersonal relationships, morale, vibration, stimulus-invariable milieu, and time perception are directly comparable to those anticipated on extended space voyages. (91 references)

1615
Williams, H. L.,
G. O. Morris, and A. Lubin
ILLUSIONS, HALLUCINATIONS AND SLEEP LOSS. —In: Hallucinations, p. 158-165. Ed. by L. J. West. New York: Grune & Stratton, 1962.

The findings on the nature of misperceptions investigated during two studies of acute sleep deprivation are reported. In the 1956 study there were twelve subjects used for a goal of 72 hours of sleep loss; in the 1957 study the goal was 98 hours of sleep loss with a total of 25 subjects. Three interviews were held with each subject—one before the experiment and two during the sleep loss period. Visual misperceptions revealed during the interviews were rated on scales. Only three scales of visual misperception, temporal disorientation, and cognitive disorganization showed consistent and statistically significant rises with increasing sleep loss. Extreme misperceptions with subjective belief in them may be labeled as hallucinations. Dreams during lapses appear to be related positively to later development of visual hallucinations. There was increasing disorientation in time as sleep loss progressed. There was also progressive inability to sustain a continuous chain of mental operations. It is suggested that neurophysiologically hallucinations are dependent on the ratio of specific afferent activity to subcortical activity. When this ratio drops, the perceptual integrating system is controlled by subcortical input rather than the specific afferent system.

1616
Wright, M. W.,
G. C. Sisler, and J. Chylinski
PERSONALITY FACTORS IN THE SELECTION OF CIVILIANS FOR ISOLATED NORTHERN STATIONS.—Jour. Applied Psychol., 47 (1): 24-29. Feb. 1963.

A test battery composed of the Minnesota Multiphasic Inventory (MMPI), Edwards Personal Preference Schedule, and Brainard Occupational Preference Inventory, as well as General Information and Arctic Interest Questionnaires was administered to a group 197 electronic technicians prior to one year of isolation duty on the Mid-Canada line. Following completion of the duty each subject was appraised and rated by his area superintendent along the parameters of work and social adjustment. Comparison of the differentiating test variables between the top-adjustment group and low-adjustment group showed that work adequacy and social adjustment were associated with 11 of the 35 test variables. The use of K correction reduced the discriminating function of MMPI. The age of the individual and urban versus rural background were also associated with successful adjustment.

1617
Wulfften Palthe, P. M. van
FLUCTUATIONS IN LEVEL OF CONSCIOUSNESS CAUSED BY REDUCED SENSORIAL STIMULATION AND BY LIMITED MOTILITY IN SOLITARY CONFINEMENT.—Aeromedica acta (Soesterberg, Netherlands), 8: 47-78. 1961-1962. In English.

Alterations in consciousness were investigated in experiments using reduced sensorial input, restricted motility, and social isolation. Recordings of physiological functions and electroencephalographic tracings demonstrated changes in the level of consciousness which began very soon upon isolation and were of a spontaneous nature during the one hour of total isolation (preceded and followed by one-hour periods of partial isolation). There were certain physiological findings, apparently individually determined, which could not be correlated either with fear or with anxiety. Subjective reports show that the individual was aware of a waxing and waning of consciousness. Time in minutes was underestimated, while the subjective "duration" was felt to be extremely long. There were some disturbances in body image and sensory illusions. All of these were considered to originate from intrinsic (endogenous) influences in the presence of insufficient extrinsic stimulation. Unconsciousness does not take place because intrinsic stimulation maintains a primitive low level brain stem consciousness. Five cases of altered consciousness with akinesia and mutism in pilots of high performance jet aircraft while in flight are discussed within this frame of reference.

1618
Ziskind, E.,
and T. Augsburg
HALLUCINATIONS IN SENSORY DEPRIVATION–METHOD OR MADNESS?—— Science (Washington), 137 (3534): 992-993. Sept. 21, 1962.

Vision was occluded for 10-minute periods in 10 normal subjects and 5 ophthalmologic patients by means of binocular eye patches. The subjects were instructed to report everything they saw in their visual fields, including changes and visual images. The experimental results and self-observation for dreams yielded visual imagery similar to sensory-deprivation hallucinations. The latter probably arise from fragments of normal imagery whose origins are unrecognized because of reduced awareness and may be brought out by methodological procedures. (Authors' summary, modified)

1619
Ziskind, E.,
R. W. Graham, L. Kuninobu, and R. Ainsworth
THE HYPNOID SYNDROME IN SENSORY DEPRIVATION.—Recent Advances in Biological Psychiatry, 5: 331-346. 1963.

Clinical evidence, e.g. behavior of ophthalmologic patients, and experimental studies on sensory deprivation point to a syndrome of reduced consciousness. This is characterized by altered goal-directed behavior, increased sleep, dream-like perceptual distortions associated with coordinated motor activity, confusion, anxiety, and restlessness. It differs from the acute brain syndrome by its brevity, the restricted number of sensory modalities involved, the absence of subcortical hyperkinesis, and sometimes the appearance of a transitory amnesia. Sleep and periods of lowered awareness are thought to be causal in production of the symptoms associated with sensory deprivation. The authors propose that this hypnoid syndrome may have occurred in all experiments on sensory deprivation which lasted eight hours or longer. Lowering of consciousness is a prerequisite condition which together with other factors may be sufficient to give rise to the "sensory deprivation" symptoms. The syndrome may be utilized as an invariable core against which various causative factors may be experimentally investigated. (29 references)

1620
Zubek, J. P.,
M. Aftanas, J. Hasek, W. Sansom, E. Schludermann, L. Wilgosh, and G. Winocur
INTELLECTUAL AND PERCEPTUAL CHANGES DURING PROLONGED PERCEPTUAL DEPRIVATION: LOW ILLUMINATION AND NOISE LEVEL. — Perceptual and Motor Skills, 15 (1): 171-198. Aug. 1962.

Forty-two subjects were placed individually in an isolation chamber in constant, unpatterned light and white noise. Twenty-nine of these subjects endured isolation for 7 days, the rest terminated the experiment prior to the end of the third day. Tests measuring 12 mental abilities and eight perceptual processes were administered before, during, and after isolation. Forty ambulatory subjects and 40 recumbent subjects were used as controls. Significant impairments were found on 8 of the 12 mental abilities measured (cancellation, dexterity, number facility, numerical reasoning, abstract reasoning, space relations, verbal fluency, and recognition). Some suggestions were present that adaptation to deprivation conditions may be possible. The results from the recumbent control group indicated that the factor of motility is important in numerical reasoning and possibly in space visualization and verbal fluency. Perceptually there were significant impairments in visual and auditory vigilance, color discrimination, reversible figures test, and pain sensitivity. A comparison with results of an earlier study indicated that sensory and perceptual deprivation are not equivalent behaviorally. (Authors' summary, modified)

1621
Zubek, J. P.,
G. Welch, and M. G. Saunders
ELECTROENCEPHALOGRAPHIC CHANGES DURING AND AFTER 14 DAYS OF PERCEPTUAL DEPRIVATION.—Science (Washington) 139 (3554): 490-492. Feb. 1963.

Three male subjects were kept in an isolation chamber and exposed to constant white noise (earphones) and an ambient illumination level of 20 foot-candles. After 14 days of deprivation there was a significant decrease in alpha wave frequencies (waves per second). At the end of a week's recovery period the frequencies were still abnormal, and long-lasting motivational losses were found.

1622
Zubek, J. P.
and G. Welch
ELECTROENCEPHALOGRAPHIC CHANGES AFTER PROLONGED SENSORY AND PERCEPTUAL DEPRIVATION.—Science (Washington), 139 (3560): 1209-1210. March 22, 1963.

Electroencephalographic tracings were taken from four groups of subjects, ten male university students in each, who were exposed for seven days to the following conditions: (1) sensory deprivation with movement restriction, isolation, darkness, and silence; (2) perceptual deprivation with isolation, constant unpatterned light, and white noise; (3) a recumbent control condition, unrestricted socially in "normal" environment; and (4) an ambulatory control condition. All 20 experimental subjects showed a post-isolation decrease in occipital lobe frequencies; the mean decrease was significantly greater for the perceptual group than for the sensory deprivation group. The experimental groups also had an excess of slow or theta activity particularly from the temporal leads.

m. Restraint

1623
Caraway, B. L.,
R. H. Edwards, and J. E. Cook
A CLINICAL EVALUATION OF 14-DAY RESTRAINT STUDIES IN THE CHIMPANZEE.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6892). Technical Documentary Report no. ARL-TDR-63-7, April 1963. v+47 p.

Two immature male chimpanzees were subjected to continuous body restraint for 14-days. One subject was subjected to semi-isolation in a test cubicle. The second restrained subject served as a control with limited, but continuous, contact with laboratory personnel. The different reactions of the two subjects to restraint environments are discussed and results of collected physiological data on both animals are presented. (Authors' abstract)

1624
Gordienko, V. M.,
and A. M. Bilous

[CONTENT OF CERTAIN MICROELEMENTS IN BONE TISSUE DURING IMMOBILIZATION] Vmist deiakykh mikroelementiv v kistovii tkanyni pry immobilizatsii.—Ukrains'kyi biokhimichnyi zhurnal (Kyiv), 35 (3): 428-435. 1963. In Ukrainian, with English summary (p. 434-5).

The content of microelements (iron, manganese, copper, and aluminum) was investigated in the femur of an immobilized limb, in the symmetrical mobile limb, and in a distant bone segment (humerus) of rabbits. The duration of immobilization varied from 5 to 360 days. The quantitative determination of the microelements was carried out by the method of emission spectral analysis. During the first days of immobilization the content of all microelements increased considerably. From the 10th to 15th day on there was a pronounced decrease. Throughout the following period of immobilization the content of microelements fluctuated around a value below the normal. These changes occurred in all investigated bone segments; however, they were most marked in the femur of the immobilized limb. These data indicate that immobilization of one extremity affects the processes of metabolism and the reactivity of the organism as a whole. (From the authors' summary)

1625
Tkachenko, Z. IA.

[MORPHOLOGICAL CHANGES IN THE NEURONS OF THE REFLEX ARC OF THE POSTERIOR EXTREMITIES DURING PROLONGED IMMOBILIZATION] Morfologichni zminy v neironakh reflektornoi dugy zadnikh kintsivok pri trivalii immobilizatsii.—Fiziologichnyi zhurnal (Kyiv), 9 (3): 383-384. 1963. In Ukrainian.

In a total of 12 rabbits the posterior extremities were immobilized for periods up to 31 days. After 15 days the neurons on the corresponding spinal ganglia showed in 10.7% of the cases vacuolation of the neuroplasm, in 6.5% pyknotic unclei, and in 8% cellular necrosis. The spinal cord showed a considerable increase in glial elements and the sciatic nerve a significant increase in argentophilia.

n. Radiations

1626
Allkofer, O. C.,
E. Bagge, and J. Trümper

[INVESTIGATIONS OF THE RADIATION HAZARDS TO THE FLIGHT CREW AND THE GROUND PERSONNEL OF JET AIRCRAFT. III. THE MEASUREMENT OF THE RADIATION HAZARD FROM COSMIC RADIATION] Untersuchungen über die Strahlengefährdung der Flugbesatzung und des Bodenpersonals von Düsenflugzeugen. III. Messung der Strahlenbelastung durch die kosmische Ultrastrahlung.—Atomkernenergie (München), 7 (7/8): 249-257. July/Aug. 1962. In German, with English summary (p. 249).

Using a plastic scintillator, the radiation absorption dose was measured on board a jet aircraft of the type Boeing 707. The investigations were carried out on the North Atlantic Route and the Far East Route of the Lufthansa. With respect to their characteristics of energy loss the plastic scantillator and the human body are very similar to each other. Thus the measurements may be used directly to judge the radiation hazard. The measurements took place in the region up to 38,000 feet and between latitudes of 3°N and 60°N. For the 38,000 feet level on the North Atlantic Route (50° to 60° N) a radiation absorption dose of 0.19 mrad/hr. was measured. At the geomagnetic equator the value is 1.8 times lower. (Authors' summary)

1627
Auerbach, R.
and G. D. Weinstein

OCCUPATIONAL ULTRAVIOLET LIGHT AND SKIN DISEASE: TWO CASE REPORTS.—Arch. Dermatology, 87 (6): 691-692. June 1963.

A case of discoid lupus erythematosus and a case of a polymorphous light eruption are reported. The former was initiated by occupational ultraviolet light exposure. The second case was elicited by occupational exposure in a patient who had a ten-year history of sunlight sensitivity. Occupational exposure to ultraviolet light should be a consideration in light-sensitivity disease especially when the lesion is in an unusal location, as in the first patient, or at an unusual time of the year, as in the second patient. (Authors' abstract)

1628
Ballesté, C. F.,
and A. G. Zíngano

[MEDICAL ASPECTS OF THE OPERATION OF RADAR AND SIMILAR APPARATUS] Aspectos sanitários de operação de aparelho de radar e congêneres.—Revista médica da aeronáutica (Rio de Janeiro), 14 (1-4): 3-14. Jan.-Dec. 1962. In Portuguese.

Persons working with and around radar apparatus are exposed to various hazards. These may arise from: (1) electric shock, which can cause blood, skin, heart, respiratory, and nervous system disorders; (2) radioactivity from radar tubes and other radioactive material (x-, alpha-, beta-, gamma-ray types), which affect the blood and skin; and (3) microwaves, which alter cellular and body metabolism, neuromuscular function, and, as evidenced by animal experiments, cause cataracts. Various therapeutic methods are discussed for persons suffering from excess exposure to the radar environment, and preventive measures are evaluated which can be instituted in the work areas where radar apparatus is used.

1629
Boysen, J. E.

USAF EXPERIENCE WITH MICROWAVE EXPOSURE. —Jour. Occupational Med., 4 (4): 192-194. April 1962.

Some of the operations are described in which Air Force personnel are subjected to microwave or radar irradiations. Various wavelengths and frequencies are characterized, and some of their biological effects are mentioned. Factors affecting exposure doses and rates at radar sites such as positioning of antennae and transmitters are discussed. Special problems in ground operation of aircraft-based radar are noted.

1630
Bredemeyer, H. G.,
O. A. Wiegemann, A. Bredemeyer, and H. R. Blackwell
RADIATION THRESHOLDS FOR CHORIORETINAL BURNS.—Ohio State Univ. Inst. for Research in Vision and Dept. of Ophthalmology (Contract AF 33(616)-7583); issued by Aerospace Medical Division. Biophysics Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6301, Task no. 630103). Technical Documentary Report no. AMRL-TDR-63-71, July 1963. iv+38 p.

Eyes of live rabbits were exposed to electromagnetic radiation of different spectral distributions to compare their effectiveness in producing chorioretinal burns when retinal image size and (in most cases) exposure time remained constant. The experiments were limited to the spectral range between 200 and 3000 millimicra. A carbon Jet-arc served as radiation source in most cases. Results were differentiated for three groups of fundus pigmentation. It was found that ultraviolet is virtually ineffective. The effectiveness of the visible and infared regions of the spectrum is considerably greater, and depends upon wavelength: the longer the wavelength the higher the energy threshold measured at the cornea. Present experimental data and related data published by other authors were used to infer a spectral effectiveness function for chorioretinal burns. A separate function is presented for threshold and for suprathreshold burns. The data of this and related experiments are used to derive relations between burn diameter, exposure duration, and burn threshold. A calculational method is described which permits calculation of whether or not a burn is to be expected, based upon physical data on the source such as intensity, size, distance, duration, and spectral composition. (Authors' abstract)

1631
Chisum, G. T.,
and J. H. Hill
DYNAMIC SIMULATION OF THE A4D FLASH BLINDNESS PROTECTIVE SYSTEM.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. (Problem Assignment no. 012 AE 13-13). Report no. NADC-MA-6312, July 25, 1963. iv+16 p.

Operation of the A4D thermal protective system consisting of a buggytop thermal enclosure and ELF goggles was evaluated under acceleration stresses of 1.2 to 5 g. Five experienced pilots and three non-pilot subjects operated the system within empirically predetermined limits of safety. All subjects were within the 5th to 95th percentile size range of navy pilots. Subjects in the lower third of the size range exhibited greater facility in operation of the system than those in the upper two-thirds of the size range. Recommendations are made for the location of spare ELF goggles in the A4D cockpit and preferred procedures to be followed in the operation of the thermal protective system. (Authors' summary)

1632
Cieciura, L.,
and L. Minecki
[PATHOLOGICAL CHANGES IN THE TESTES OF RATS SUBJECTED TO THE SINGLE OR REPEATED ACTION OF MICROWAVES ("S" BAND)] Zmiany histopatologiczne w jądrach szczurów poddawanych jednorazowemu i wielokrotnemu działaniu mikrofal (pasmo "S"). — Lekarz wojskowy (Warszawa), 38 (6): 519-530. 1962. In Polish, with French summary (p. 530).

Histopathological examination of the testes of 25 rats following single local or repeated general microwave irradiation (S band) showed distinct vascular, hemorrhagic, and degenerative vacuolar lesions, and disorders in spermatogenesis. Changes produced by local irradiation demonstrated a recessive tendency after 7 days, while changes occurring after repeated irradiations (every day for 6 weeks) became more extensive, even 6 weeks following the last exposure. When irradiation produces translocation of the germinative epithelial layers so that spermatocytes, spermatids, and immature spermatozoa are found in the seminiferous tubules and epididymal canal, sperm examination may be useful in evaluating the condition of germinative epithelial lesions. (Authors' summary)

1633
C[ogan], D. G.
AEROSPACE PROBLEMS. —Arch. Ophthalmol., 67 (5): 546. May 1962.

A discussion is presented of the problem of eye protection in space travelers from the near infrared and visual light radiation from the sun. Examples of chorioretinal burns from atomic explosions are cited, and the principles of the causes of these burns are briefly discussed. It is stressed that more data are needed of the effects of the visible and infrared radiation.

1634
Corry, J. E.,
and D. E. Stogryn
A NEW ANALYTICAL METHOD FOR DETERMINING DOSE RATES IN ABSORBER SYSTEMS EXPOSED TO SPACE RADIATION.—Proceedings of the Lunar and Planetary Exploration Colloquium, 3 (2): 107-116. May 5, 1963.

A new analytical method for determining dose rates in absorber systems exposed to space radiation is described in the context of the problematic status of space radiation measurements, biological effects criteria, and the available techniques used to calculate dose rates. Included are representative figures and tables. (Authors' abstract)

1635
Crawford, G. W.
APPLICATION OF SEMICONDUCTOR RADIATION DETECTORS TO RADIOBIOLOGIC PROBLEMS.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775701). Technical Documentary Report no. SAM-TDR-63-25, Aug. 1963. iii+9 p.

The experimental characteristics of semiconductor particle detectors were studied extensively to determine response, resolution, rise time, stability, and irradiation effects. Surface-barrier detectors, diffused P-N junction detectors, and ion-drifted P-i-N detectors were exposed to many different energies of protons, electrons, photons, and neutrons. The characteristics of the response of each type of detector to each type of ionizing radiation were determined as a function of geometry and operating conditions. This basic information concerning the detectors is being used to solve radiobiologic problems in the laboratory and in space. The applications include: (1) particle identification, (2) energy spectrum measurement, (3) energy absorbed in the silicon from the ionizing particle, (4) translation of energy absorbed in silicon to energy absorbed in tissue, i.e., dose measurement, and (5) depth dose measurements by embedding detectors in animals (Author's abstract) (28 references)

1636
Curtis, H. J.
SOME SPECIFIC CONSIDERATIONS OF THE POTENTIAL HAZARDS OF HEAVY PRIMARY COSMIC RAYS.—In: Proceedings of the symposium on the protection against radiation hazards in space (Gatlinburg, Tenn., Nov. 5-7, 1962), book 1, p. 291-308. U. S. Atomic Energy Commission, Washington, D. C., Report no. AEC-TID-7652.

The ionization produced by the heavy cosmic ray particles is almost entirely highly concentrated along single tracks, and the microscopic dose in tissue within these tracks may be quite high but the overall dose rate from these particles in outer space would be very low. These particles cannot be produced in the laboratory, so a microbeam of deuterons was developed which simulates the ionization pattern of these particles. Using this microbeam on mice it is found that this type of radiation causes very little effect in either the brain or the eye, and presumably also in other vital organs. However, it will cause greying of the hair. It is concluded that this type of radiation will not cause a serious hazard for space flight. (Author's summary)

1637
Curtis, H. J.
THE BIOLOGICAL EFFECTS OF HEAVY COSMIC RAY PARTICLES.—In: Life sciences and space research, p. 39-47. Ed. by R. B. Livingston and others. Amsterdam: North-Holland Publishing Co., 1963.

A very narrow beam of 22 MeV deuterons has been developed which will have the same biological effect as the track of a very heavily ionizing particle. Using this microbeam the following results have been obtained on mice: (1) brain tissue is very insensitive to this type of radiation; (2) this radiation will cause minute abnormalities in the lens of the eye but in general these do not progress to form cataracts; but if they do, they remain extremely small; (3) if a hair follicle is hit, the hair from that follicle will turn gray. It is concluded that the heavy cosmic ray particles do not pose a serious problem for manned space flight. (Author's abstract, in part)

1638
Curtis, H. J.,
and H. H. Smith
CORN SEEDS AFFECTED BY HEAVY COSMIC RAY PARTICLES.—Science (Washington), 141 (3576): 158-160. July 12, 1963.

Corn seeds of a special genetic stock were recovered from two satellite flights occurring at an altitude of about 280 kilometers. Plants were grown from these seeds and examined for abnormalities. Some evidence for a slight increase in chromosomal deletions was observed, which was predicted from the flux of heavy primary particles, primarily stripped atomic nuclei with masses as high as iron and traveling at very high speeds. (Authors' abstract, modified)

1639
Drogichina, E. A.,
M. N. Sadchikova, D. A. Ginzburg, and N. A. Chulina
[SOME CLINICAL MANIFESTATIONS OF CHRONIC EXPOSURE TO CENTIMETER WAVES] Nekotorye klinicheskie proiavleniia khronicheskogo vozdeistviia santimetrovykh voln.—Gigiena truda i professional'nye zabolevaniia (Moskva), 6 (1): 28-34. Jan. 1962. In Russian, with English summary (p. 34).

The effects of centimeter-range electromagnetic waves on human subjects were studied by recording the galvanic skin reflexes and electroencephalograms during rest and stimulation. Subjects chronically exposed to ultra-high frequency waves showed the following effects: in almost all cases the α-waves were clearly expressed (α-index, 50-90%) as well as the waves with medium and long amplitudes. Approximately half of the subjects showed pathological changes: slow θ and δ waves appeared sporadically and frequently alternated with normal α-waves. The electrocardiogram revealed a tendency towards a slight ventricular inhibition, while the biochemical assay showed a rise of histamine and globulin concentration in the blood and a decrease in the albumin/globulin ratio. The clinical syndrome was characterized by vascular manifestations expressed as frequent headaches, paleness of the facial skin, general hyperhydrosis, adynamia, acute emotional instability, hallucinations, inhibition of memory, tremor, and pulse and arterial pressure lability.

1640
Edelwejn, Z.,
and S. Haduch
[ELECTROENCEPHALOGRAPHIC STUDIES ON PERSONS WORKING WITHIN THE REACH OF MICROWAVES] Badania elektroencefalograficzne osób zatrudnionych w zasięgu działania mikrofal. — Acta physiologica polonica (Warszawa), 13 (3): 431-435. May-June 1962. In Polish, with English summary (p. 435).

A series of periodical examinations were carried out on 120 persons working within fields of high-frequency electromagnetic waves. Case-history analysis and morphological evaluation of the electroencephalographic records showed a significantly large number of complaints submitted by individuals exposed to microwaves for more than three years. Moreover, there was a distinct preponderance of EEG records with subnormal bioelectric activity in the individuals exposed to microwaves for a period of more than one year as compared to those with less than a year's exposure. Successive EEG investigations under metrazol provocation and photostimulation revealed a significantly greater number of positive test changes in individuals exposed to the microwaves for a period longer than three years. (Authors' summary, modified)

1641
Ellinger, F. P.
INFLUENCE OF SOLAR RADIATION ON HEALTH AND DISEASE. I. GENERAL PRINCIPLES.—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 336-338. Amsterdam: Elsevier Publishing Company, 1963.

A review is presented of the historical background of studies dealing with influence of sunlight on health leading up to the discovery of ultraviolet rays as the active component of sunlight. (58 references)

1642
Ellinger, F. P.
BIOLOGICAL EFFECTS OF ULTRAVIOLET RADIATION.—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 338-345. Amsterdam: Elsevier Publishing Company, 1963. 991 p.

Biological phenomena discussed under local effects of ultraviolet radiation on the human body include photoerythema, photopigmentation, increased cornification, photoadaptation, vitamin D formation, photosensitivity, bleaching effect on hair, and inflammation reactions of the eye. The general systemic effects are considered to be due to histamine or histamine-like substances released in the circulatory system after being formed as the result of exposure of the skin to sunlight. Some of the effects reported are increased gastric secretion and gastritis; a fall in blood pressure; an increase in the number of erythrocytes, an increase in the hemoglobin value; increases in the calcium, potassium, sodium, and phosphorus contents; a reduction of the respiratory quotient, and an increase in the protein metabolism. There is some indication of changes in the activity of the thyroid, the adrenal cortex, and the ovary, dependent on the amount of ultraviolet radiation. (27 references)

1643
Ellinger, F. P.
BIOLOGICAL EFFECTS OF INFRARED RADIATION (HEAT RAYS).—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 345-346. Amsterdam: Elsevier Publishing Company, 1963.

The local effects of infrared radiation are quite similar to those produced by heat conduction. Some of these are heat pigmentation after repeated exposures to infrared, photoophthalmia, and cataract formation. The general effects on the human body are not different from those produced by heat conduction.

1644
Ellinger, F. P.,
and S. W. Tromp
BIOLOGICAL EFFECTS OF VISIBLE LIGHT.—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 346-348. Amsterdam: Elsevier Publishing Company, 1963.

Little is known about the effect of spectral colors of visible light on the human and mammalian body. There is some evidence of a sensory organ for spectral colors in the human skin. A stimulating effect of the wavelengths in the purple to red end of the spectrum has been shown for the hypothalamus and indirectly via the pituitary on the gonads. Vitamin B_1 biosynthesis has been shown to be affected by the wavelength of visible light. Experiments with birds kept in continuous darkness suggest that light accelerates the seasonal rhythm of gonadal activity initiated by the hypothalamic-pituitary system. Extended periods of continuous darkness result in regressive structural alterations of the hypothalamic cells in rats.

1645
Ershoff, B. H.,
and G. S. Bajwa
EFFECTS OF ANTIOXIDANTS ON RESISTANCE TO RADIATION INJURY.—Western Biological Labs., Culver City, Calif. (Contract AF 33(657)-8401); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 716405). Technical Documentary Report no. AMRL-TDR-63-28, March 1963. vi+25 p.

Since BHT (butylated hydroxytoluene) and certain other antioxidants significantly prolonged the average survival time of mice exposed to multiple sublethal doses of total body X-irradiation, experiments were undertaken to determine the effects of antioxidants of diverse structure and activity and antioxidant synergists on length of survival following continuous exposure to a lethal dose of total body gamma radiation in the rat. BHT when fed at a 0.5% level in a purified diet and ascorbic acid at a 0.1% level significantly increased the average survival time of irradiated rats over that of rats fed the unsupplemented purified diet. Polygard (tri(nonylated phenyl) phosphites) when fed at levels of 0.25% and 0.5% and citric acid and phosphoric acid at levels of 0.1% in the purified diet also appeared to have some activity in this regard. Other antioxidants tested had little if any protective effect. The average survival time of irradiated rats was significantly longer for rats fed a natural food stock ration than for those fed the basal purified diet. No correlation was observed between the weight increment, organ weights, or microscopic appearance of the tissues of irradiated rats with length of survival on any of the diets employed. (Authors' abstract)

1646
Everett, M. A.,
A. T. Bever, and J. H. Anglin
CUTANEOUS PROTECTION AGAINST ULTRAVIOLET LIGHT.—Dermatologia tropica, 1 (3): 123-126. Oct.-Dec. 1962. In English, French, and Spanish.

A discussion is presented of the biological mechanisms that the human organism can employ in the natural protection against ultraviolet light. The production of urocanic acid in the skin is discussed, and speculations on the action of the acid are made. It is thought that urocanic acid is the major factor in protection of the skin from ultraviolet damage. Persons who are more susceptible to collagen degeneration and skin carcinoma probably have less production of urocanic acid in the keratin layer.

1647
Faitel'berg-Blank, V. R.
[ABSORPTIVE GASTRIC AND INTESTINAL ACTIVITY UNDER THE INFLUENCE OF THE ULTRAHIGH-FREQUENCY ELECTRIC FIELD] Vsasyvatel'naia deiatel'nost' zheludka i kishechnika pod vliianiem elektricheskogo polia UVCh.—Fiziologicheskii zhurnal SSSR (Moskva), 48 (6): 735-741. 1962. In Russian.

The absorptive activities of the digestive tract under the influence of an ultrahigh-frequency electromagnetic field were studied in 6 dogs which had solutions of glucose, glycine, and sodium chloride introduced into the stomach and intestine. The animals were exposed to a 10-watt electric field of 7.3 m. wave length for 10 minutes. Absorption in both the intestine and the stomach increased as follows: glucose, 7-8% in the intestine, 4-5% in the sotmach; water, 63.6-66.6% and 5-10%, respectively; glycine, 3-5% in both organs; and chloride ions 12-15% (intestine) and 5-6% (stomach).

1648
Faitel'berg-Blank, V. R.
[THE EFFECT OF CENTIMETER-BAND RADIO WAVES ON THE ABSORPTION OF AMINO ACIDS, CHLORIDES, AND WATER IN THE STOMACH AND INTESTINE] Vpliv radiokhvil' santimetrovogo diapazonu na vsmoktuvannia aminokislot, khloridiv i vodi u shlunku ta kishechniku.—Dopovidi Akademii nauk Ukrains'koi RSR (Kiev), 1962 (10): 1367-1370. 1962. In Ukrainian, with English summary (p. 1370).

Three dogs with Pavlov pouches and three with an isolated loop in the small intestine were given solutions of amino acids and chlorides and exposed to microwave action. Exposure to a 50-watt electric field for 10 minutes resulted in increased absorption of amino acids, chlorides, and water in both the stomach and intestine.

1649
Fallowfield, T. L.
THE INFLUENCE OF HYPOTHERMIA INVOLVING MINIMAL HYPOXIA ON THE RADIOSENSITIVITY OF LEUCOCYTES IN THE RAT.—International Jour. Radiation Biology and related studies in Physics, Chemistry and Med., (London), 4 (5): 457-464. Feb. 1962.

Rats were irradiated with 357 rads of gamma-rays at normal body temperatures and some body-temperatures of less than 5°C. The method of induction of hypothermia was designed to produce minimal anoxia. White-cell counts were performed up to seventeen days after irradiation. Depression of the lymphocyte count was seen in all animals irradiated, recovery being nearly complete at the end of the study. The depression observed was similar in the cooled and uncooled groups, apart from the values obtained two days after irradiation. It is concluded that hypothermic radioprotection of the lymphopoietic tissues is dependent on anoxia. (Author's abstract)

1650
Fitzpatrick, T. B.,
M. A. Pathak, I. A. Magnus, and W. L. Curwen
ABNORMAL REACTIONS OF MAN TO LIGHT.—Annual Rev. Med., 14: 195-214. 1963.

A review is presented of the effects of ultraviolet and visible light on human tissues. A brief discussion is given of the biophysical characteristics of light and of the normal responses of human skin to light. Photosensitization by light alone or by light in conjunction with exogenous agents and metabolites is discussed. Abnormal conditions of the skin and various skin diseases related to exposure to sunlight are reviewed. (80 references)

1651
Foelsche, T.,
and E. H. Graul
RADIATION EXPOSURE IN SUPERSONIC TRANSPORTS.—Atompraxis (Karlsruhe), 10 (8): 365-380. Oct. 1962. In English.

Exposure levels at 75,000 feet (24 kilometers) altitude for flight personnel and passengers in supersonic transport operations are estimated on the basis of recent data, and compared with the maximum permissible exposure for normal peacetime operations recommended in 1958 in the guide lines of the International Commission on Radiological Protection. The biological meaning of low-level radiation doses, which are compared with other civilizational mutagens, and the relative biological effectiveness of important components of the relevant cosmic radiations and their secondaries are discussed. In particular, an attempt is made to estimate the possible contribution made by passengers to the genetic radiation burden on the over-all population. The article presents reasons for assuming that the genetic burden on the population as a result of the exposure of supersonic transport flight passengers to radiation will amount to only 0.5%. (Authors' Summary)

1652
Foelsche, T.
ESTIMATES OF RADIATION DOSES IN SPACE ON THE BASIS OF CURRENT DATA.—In: Life sciences and space research, p. 48-94. Ed. by R. B. Livingston and others. Amsterdam: North-Holland Publishing Co., 1963.

A gross survey of data on Van Allen belt radiations, galactic cosmic radiation, and solar cosmic radiation is presented. On the basis of these data, in part fragmentary and uncertain, upper and lower limits of rad doses under different amounts of mass shielding are estimated. The estimates are preliminary especially in the cases of chance encounter with solar flare protons. Generally, the relative biological effectiveness of the high energy space radiations appear insufficiently known to give detailed biological or rem doses. (Author's abstract, in part) (52 references)

1653
Frey, A. H.
SOME EFFECTS ON HUMAN SUBJECTS OF ULTRA-HIGH-FREQUENCY RADIATION.—Amer. Jour. Med. Electronics, 2 (1): 28-31. Jan.-March 1963.

Data are presented which indicate that ultra-high frequency radiation can induce effects at average power densities below the currently accepted hazard limit of 10 mw./cm^2. It was found that the perception of sound can be induced in human subjects and the possibility of an effect on the heart was indicated. Limitations in the data are pointed out, but there is no question as to the existence of the effects. (Author's summary)

1654
Giurdzhian, A. A.
[RADIOBIOLOGICAL PROBLEMS OF SPACE FLIGHT] Radiobiologicheskie problemy kosmicheskikh poletov. — Problemy kosmicheskoi biologii (Moskva), 1: 27-103. 1962. In Russian, with English summary (p. 102-103).

A review is presented of the radiobiological problems encountered in space flight. Physical aspects of cosmic radiation, radiation belts, the interaction between cosmic ray particles and substances, and the principles of radiation protection in space flight are discussed. The section on biological effects of cosmic rays deals with the determination of their relative biological effects, ionization of tissues, probable genetic alterations, the combined action of cosmic radiation and other factors, and the influence of radiation on various forms of life. Ground-based and flight experiments in the Soviet Union and abroad are reviewed. (321 references)

1655
Giurdzhian, A. A.
[STUDIES OF THE BIOLOGICAL EFFECT OF COSMIC RADIATION ON SPACESHIPS] Issledovaniia biologicheskogo deistviia kosmicheskoi radiatsii na korabliakh-sputnikakh.—Problemy kosmicheskoi biologii (Moskva), 2: 93-97. 1962. In Russian, with English summary (p. 96-7).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 100-103. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The radiation dose absorbed inside the second Russian space ship was about 10 millirad a day. No artificially induced radioactivity was found. Medical examination of dogs, rats, mice, and guinea pigs immediately after the flight and a follow-up examination later revealed no peculiarities in their general condition, behavior, and physiological functions. Biochemical and immunological methods of investigation showed a transitory stress reaction. Microbiological and cytological objects, including Chlorella algae did not differ from the controls. A number of genetic and cytological methods of investigation revealed increase in the frequency of chromosomal aberrations. Some biological objects displayed a stimulated growth and mitosis. Laboratory tests showed that vibrations exerted effects similar to those occurring during a space flight. This requires a close study of the role of the mechanical factors of the flight.

1656
Glembotskii, IA. L.,
E. A. Abeleva, Iu. A. Lapkin, and G. P. Parfenov
[EFFECT OF SPACE FLIGHT CONDITIONS ON THE FREQUENCY OF APPEARANCE OF LETHAL RECESSIVE MUTATIONS IN THE X-CHROMOSOME OF DROSOPHILA MELANOGASTER] Vliianie faktorov kosmicheskogo poleta na chastotu vozniknoveniia u Drosophila melanogaster v X-khromosome retsessivnykh letal'nykh mutatsii. — Problemy kosmicheskoi biologii (Moskva), 1: 219-231. 1962. In Russian, with English summary (p. 231).

Two genetic lines of Drosophila melanogaster (D-32 and D-18) were carried on Sputnik-2. The duration of flight was twenty-two hours. Both lines showed a statistically certain increase of mutation frequencies after the space flight. The higher mutation frequencies in spermatides as contrasted to spermatozoa suggest the possibility of a cosmic radiation effect. The D-18 line, which has a higher incidence of spontaneous mutations, was more sensitive to space flight. Twenty lethal mutations examined cytologically appeared to be point mutations.

1657
Gorodetskaia, S. F.
[MORPHOLOGICAL CHANGES IN INTERNAL ORGANS OF ANIMALS PRODUCED BY THE ACTION OF CENTIMETER WAVES ON THE ORGANISM] Morfologichni zminy vnutrishnikh organiv pry vplyvi na organizm santymetrovykh khvyl'. — Fiziologichnyi zhurnal (Kyiv), 8 (3): 390-396. May-June 1962. In Ukrainian, with Russian summary (p. 396).

Irradiation of animals with 3-cm. electromagnetic waves (0.4 w./cm.^{2}) is not harmless to animals (mice). A short time after irradiation there appear distinct hemodynamic disorders, i.e., hyperemia and hemorrhages in almost all internal organs. Protein dystrophy leading to micronecroses in the heart and liver was noted in almost all cases. Investigation of the sexual organs disclosed that the ovaries were affected to a significantly greater extent than the testes. A control series in which warming by heat convection was employed produced less marked and quickly regressing changes in the hemodynamics.

1658
Gorodetskaia, S. F.
[EFFECT OF CENTIMETER RADIO WAVES ON THE FERTILITY OF FEMALE MICE] Vplyv santymetrovykh radiokhvyl' na plidnist' samok myshei.— Fiziologichnyi zhurnal (Kyiv), 9 (3): 394-395. 1963. In Ukrainian.

Mice exposed to 3-cm. electromagnetic waves showed a decreased fertility. The greatest incidence in still-born progeny (11%) was observed immediately after exposure, thereafter the incidence decreased but remained higher than in controls. Histological examination of the ovaries indicated a high incidence of follicular pathology.

1659
Graevskii, E. Ia.
[THEORETICAL ASPECTS OF THE CHEMICAL PROTECTION OF MAMMALS FROM IONIZING RADIATION] Teoreticheskie aspekty khimicheskoi zashchity mlekopitaiushchikh ot ioniziruiushchei radiatsii.—Zhurnal obshchei biologii (Moskva), 24 (1): 3-22. Jan.-Feb. 1963. In Russian.

A general summary is presented of the biological effects produced by ionizing radiation. It includes the following conclusions of interest to aerospace medicine: Reduction in oxygen tension resulting in either generalized or local hypoxia represents one of the most effective mechanisms of radiation protection. Therefore, any type of hypoxia induced by such factors as a reduction in oxygen tension of the inspired air, inactivation and hemoglobin, inhibition of the respiratory center, activation of tissue respiration, and hematic stasis is of importance as a contributing factor of increased biological tolerance to ionizing radiation. (131 references)

1660
Grahn, D.
LATE EFFECTS IN MAN FOLLOWING EXPOSURE TO IONIZING RADIATIONS.—In: Proceedings of the symposium on the protection against radiation hazards in space (Gatlinburg, Tenn., Nov. 5-7, 1962), Book 1, p. 275-290.

The late effects of radiation exposure are examined in two broad categories, somatic and genetic. The somatic effects are those found in the irradiated individual; the genetic effects are those transmitted or transmissible to the offspring as a result of radiation-induced change in the reproductive tissues. Physical-exposure parameters and biological expectations are discussed as they relate to these categories. The relationship of the latter to space-flight missions is also discussed. It is suggested that presently-accepted standards of operational radiation safety for occupational and emergency situations have little meaning for these flight missions. Final judgment will depend not only on biological and medical considerations, but also on the total complex of engineering and bioastronautics capabilities. Genetic endpoints, in a sense, are not biologically controllable, but the hazard here is statistically manageable in that only a tiny fraction on the total reproductive population is involved. Somatic endpoints are in part medically manageable so that valuable personnel need not be subjected to any maximum calculable risk, based upon total absorbed dose. (25 references)

1661
Greene, L. C.,
and J. D. Hardy
ADAPTATION OF THERMAL PAIN IN THE SKIN. — Jour. Applied Physiol., 17 (4): 693-696. July 1962.

Cutaneous pain thresholds were determined on blackened skin of foreheads and forearms of human subjects over areas of 16 cm.^{2} by recording skin temperature during exposure to thermal radiation for periods up to 50 minutes. Intensity of stimulus was controlled by the subject so that threshold pain was maintained throughout the exposure. After the initial period of adjustment by the subject, radiation intensity was generally maintained constant although skin temperature for the pain threshold decreased from 44.9° to 43.8° C. By using an intensity as low as 22 mcal./cm.^{2}/second, threshold pain was evoked in 29 minutes at a skin temperature of 42.2° C. In both groups, once pain had been established it did not disappear. It is inferred from these observations that thermal pain does not adapt for near-threshold stimulation in the period between onset of pain at 30 seconds and termination of stimulation. (Authors' abstract)

1662
Horai, H.
BIOLOGICAL EFFECTS OF MICROWAVE RADIATION. I. ALTERATION OF THE RECTAL TEMPERATURE OF THE MICE DURING THE MICROWAVE RADIATION AND MICROSCOPIC FINDINGS OF DESTROYED CASES. — Nihon Igaku Hōshasen Gakkai Zasshi (Nippon acta radiologica) (Tokyo), 22 (2): 173-181. May 25, 1962. In Japanese, with English summary (p. 173-174).

Mice exposed to microwave radiations generated by a magnetron apparatus for 1-2 minutes exhibited a rise in rectal temperature. The minimum lethal intensity was 27.1 mW/cm.^{2}. At radiations lower than the lethal dose, the rectal temperature rose to a certain level and remained elevated during exposure. In this condition, it was assumed that heat production caused by microwave radiation was equal to the quantity of heat radiated from the body surface (3 hours of exposure did not prove lethal to the mice). Under high-power radiation, the rectal temperature rose rapidly and the animals died early during exposure. Pathological changes were observed in the lungs, liver, kidneys, brain, spleen, and other organs. Microscopic findings were congestion of small blood vessels and interstitial bleeding in these organs. These changes were similar to those seen when a mouse was heated and destroyed in a paraffin-melting apparatus. (Author's summary, modified)

1663
Iarmonenko, S. P.,
G. A. Avrunina, V. S. Shashkov, and R. D. Govorun
[THE ACTION OF RADIOPROTECTIVE PREPARATIONS AGAINST WHOLE-BODY IRRADIATION WITH HIGH-ENERGY PROTONS] Deistvie radiozashchitnykh preparatov pri obshchem obluchenii protonami vysokikh energii.—Problemy kosmicheskoi biologii (Moskva), 2: 388-392. 1962. In Russian, with English summary (p. 392).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, F. V., no. 18,395), 2: 397-400. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The radioprotective action of a number of chemical agents (beta-mercaptoethylamine, serotonine, S,beta-aminoethylisothiuronium, etc.) was investigated in experiments on mice subjected to total irradiation with protons of 660 Mev obtained in the synchrocyclotron in Dubna. S,beta-aminoethylisothiuronium proved to be most effective; it gave about 100% survival at an irradiation with 1450 rad (LD 100/10). Manifestation of the "oxygen effect" under the influence of high energy protons has been shown by examples of local ischemia of limb bone marrow. The relation of the mechanism of irradiation protection to the oxygen effect is discussed.

1664
Jackson, K. L.
THE LETHAL EFFECTIVENESS OF A SOLAR FLARE-TYPE DOSE DISTRIBUTION DELIVERED

TO THE RAT.—In: Proceedings of the symposium on the protection against radiation hazards in space (Gatlinburg, Tenn., Nov. 5-7, 1962), book 1, p. 375-392. U. S. Atomic Energy Commission, Washington, D. C., Report no. AEC-TID-7652.

An investigation of some biological effects produced by exposure of rats to a solar flare-type depth dose distribution was carried out. Space proton doses to bone marrow will not be appreciably attenuated by surrounding bone, and in the present study this was simulated by use of cobalt-60 gamma radiation. Depth-dose distribution, produced in rats by a filter-rotation technique, resulted in a midline dose which was 25% of the surface dose. This depth-dose is similar to that calculated for exposure of man to July 16, 1959, solar flare protons with 10 g./cm.^{2} of shielding. The 50% lethal dose (LD$_{50}$) measured at the surface of the rat was three times greater for depth-dose exposure as compared to uniform exposure. The midline LD50 was less for depth-dose exposure than for uniform exposure. The depth in the body at which the depth-dose LD$_{50}$ was equal to the uniform LD$_{50}$ was approximately 50% of the distance from the surface to the midline. The total energy absorbed at the LD$_{50}$ was 1.5 times greater with depth-dose exposure as compared to uniform exposure. Mean survival time of decedents in the LD$_{16}$-LD$_{84}$ range was significantly shorter in depth-dose exposed animals as compared to uniformly exposed animals. This suggests that depth-dose exposure produces greater injury to the intestine which was verified by measurement of intestinal weight changes. (Author's abstract) (26 references)

1665
Jacobson, J. H.,
B. Cooper, and H. W. Najac
EFFECTS OF THERMAL ENERGY ON RETINAL FUNCTION.—New York Eye and Ear Infirmary, N. Y. (Contract AF 33(616)-7685); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6301, Task no. 630103). Technical Documentary Report no. AMRL-TDR-62-96. Aug. 1962. vii+70 p.

The retinas of pigmented, grey chinchilla rabbits were exposed to the visible, and to the visible and near infrared parts of the spectrum to determine the retinal burn threshold. Rate of delivery of energy, the retinal image size, the exposure time, and the spectral characteristics of the source were varied. For a given irradiance, the dose necessary to produce a threshold burn increased with the size of the retinal image, for equal total irradiance a higher dose was necessary when the near infrared was included in the spectrum than when the visible alone was present, and for a given retinal image, the threshold dose is determined as a function of the irradiance. (Authors' abstract, modified)

1666
Jacobson, J. H.,
B. Cooper, H. W. Najac, and A. Kohtiao
THE EFFECTS OF THERMAL ENERGY ON ANTERIOR OCULAR TISSUES.—New York Eye and Ear Infirmary, N.Y. (Contract AF 33(657)-7894); issued by Aerospace Medical Division. Biophysics Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6301, Task no. 630103). Technical Documentary Report no. AMRL-TDR-63-53, June 1963. vi+39 p.

The eyes of pigmented, grey chinchilla rabbits were exposed to thermal radiation energy to determine its effectiveness in producing pathological changes in anterior ocular tissues. The study included the variation of the following parameters: tissue, rate of delivery of energy, and spectral characteristics. Preliminary findings relative to damage to the cornea and iris are presented. (Authors' abstract)

1667
Jonah, F. C.
SOLAR WEATHER FORECASTING.—Proceedings of the Lunar and Planetary Exploration Colloquium, 3 (2): 53-66; discussion, p. 67. May 5, 1963.

Before the safety of space travel for a given period of time can be determined, it is imperative that scientific experiments be devised to solve the problems presented by radiation belts, galactic cosmic rays and, especially, solar radiation following major flares. Many statistical studies have failed to yield convincing conclusions as to the variation in activity of the sunspot groups, or the radiation intensity from the high-energy proton streams which result from major solar flares. The ability to produce an accurate weather forecast for space travel is considered, after a detailed discussion of the major flares which occurred in 1958. Included are representative figures and tables. (Author's abstract)

1668
Kash, S. W.,
and R. F. Tooper
ACTIVE SHIELDING FOR MANNED SPACECRAFT. — Astronautics, 7 (9): 68-75. Sept. 1962.

The use of active shielding against harmful radiations on interplanetary voyages is discussed, in which an electrostatic or magnetic field set up in or about the space vehicle deflects harmful particles away from the vehicle. The use of a magnetic shield generated by currents in cryogenic coils made of high-field superconducting materials appears to be applicable to space travel. Once such a field has been energized no additional power is required to maintain it, except perhaps for the small power required to maintain the coil in a superconducting state. Included are various graphs, diagrams, and expressions representing charged particles in space, active and passive shielding, and electrostatic and magnetic shielding.

1669
Klimková-Deutschová, E.,
and B. Roth
[THE EFFECT OF ELECTROMAGNETIC WAVES ON THE NERVOUS SYSTEM: AN ELECTROENCEPHALOGRAPHIC STUDY] Strahlenwirkung auf das Nervensystem: Eine elektroencephalographische Studie.—Internationales Archiv für Gewerbepathologie und Gewerbehygiene (Berlin), 20 (1): 1-10. 1963. In German.

Electroencephalographic findings are reported for 41 persons exposed occupationally to centimeter-waves, 4 exposed to wave-lengths of several meters, and 1 exposed to X-rays. Subjective complaints were predominantly neurotic with emphasis on fatigue and sleepiness. Objective clinical findings were disturbances of the autonomic nervous system, more seldom disturbances of the extrapyramidal, pyramidal, cerebellar, and vestibular functions. Thirty percent of the electroencephalograms deviated from the normal. In ten cases there were only slight anomalies, but in six cases the changes were of moderate severity. Symptoms of decreased consciousness were present in 59%; in six cases there were also symptoms of other pathology. Both the EEG and clinical picture suggest a dominance of the inhibition process. Furthermore, the predominance of sleep-rhythms in EEG findings is indicative of a damage to the mesodiencephalic structures. (25 references)

1670a
Kollmann, G.,
B. Shapiro, and E. E. Schwartz
THE DISTRIBUTION AND THE CHEMICAL FORMS OF 2-MERCAPTOETHYLGUANIDINE AND BIS(2-GUANIDOETHYL) DISULFIDE GIVEN ORALLY IN PROTECTIVE DOSES TO MICE.—Albert Einstein Medical Center, Philadelphia, Pa. (Contract AF 41 (657)-300); issued by School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775703). Technical Documentary Report no. SAM-TDR-62-150, Jan. 1963. iii+6 p.

The distribution and chemical forms of 2-mercaptoethylguanidine (MEG) and bis(2-guanidoethyl) disulfide (GED) were studied in the various tissues of 8- to 10-week-old male mice 30 minutes after an oral protective dose of 400 mg./kg. of MEG-S^{35}. These substances have been used as protective agents against ionizing radiation. At 30 minutes after oral administration of MEG or GED, a significant amount of protective agent remained in the gastrointestinal tract. This accounts for some of the differences in LD$_{50/30}$ values for equal doses of protective agent by oral and intraperitoneal routes. MEG was absorbed from the intestines more rapidly than GED, and protective forms appeared in the tissues in higher concentrations after MEG. This explains the better protection provided by oral MEG as compared with oral GED. The difference in absorption rates of MEG and GED may be useful in controlling the speed of onset and the duration of protection by these agents in mice. (Authors' abstract, in part)

1670b
Konstantinova, M. M.
[EFFECT OF THE DURATION OF MODERATE HYPOTHERMIA ON THE OXYGEN TENSION IN TISSUES AND THE RADIOSENSITIVITY OF MICE] Vliianie prodolzhitel'nosti umerennoi gipotermii na napriazhenie kisloroda v tkaniakh i radiochuvstvitel'nost' myshei.—Doklady Akademii nauk SSSR (Moskva), 145 (2): 436-437. 1962. In Russian.

Mice were irradiated with rays from Co^{60} at a rate of 290-300 r./min. and the oxygen tension in spleen and liver was determined. At normal body temperature, the lethal dose was 900 r., while hypothermic mice (cooled to 18° C.) in part survived this dose of irradiation. The hypothermic animals had the oxygen tension in the liver reduced to about 54% and in the spleen to 45%. The author concludes that the increased radiation tolerance in mice is due to the hypothermia and concomitant tissue hypoxia.

1671
Kurlandskaia, E. B.
[SOME DATA ON THE BIOLOGICAL EFFECTIVENESS OF PROTONS WITH ENERGIES OF 660 MEV] Nekotorye dannye o biologicheskoi effektivnosti protonov s energiei 660 Mev.—Problemy kosmicheskoi biologii (Moskva), 2: 354-358. 1962. In Russian, with English summary (p. 358).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 363-368. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

With respect to the acute radiation syndrome, the relative biological effectiveness of 660 Mev protons compared to that of X-rays is ~0.6 (minimum lethal dose for mice, 1300-1500 rads; minimum lethal dose for rats, 1450-1550 rad; LD 50/30, ~1050 rad). With respect to the action of high-energy protons upon the gonads, the relative biological effectiveness amounts to ~1. 660 Mev protons have been found to possess a high ability to induce blastomas. Widely varying types of neoplasms (both morphologically and by location) have been discovered in 43% of the rats that died or were sacrificed within 6-18 months after irradiation. (From the author's summary)

1672
Langham, W. H.
SOME RADIOBIOLOGICAL ASPECTS OF EARLY MANNED SPACE FLIGHT.—Proceedings of the Lunar and Planetary Exploration Colloquium, 3 (2): 117-131; discussion, p. 132-134. May 5, 1963. 25 refs.

Current radiobiological information is reviewed with regard to its bearing on the potential radiation problems associated with manned space flight. Extensive studies of the acute and chronic effects of radiation exposure have been conducted by the Atomic Energy Commission. Acute sublethal effects which may impair a space crew during flight are radiation sickness, hematopoietic depression, skin disorders, and sterility. Chronic and/or delayed effects are the tendency towards general life-shortening, increase in the incidence of leukemia and other malignant diseases, and genetic effects. Factors such as species and strain, individual susceptibility, age and sex, drugs, hypoxia, hypo- and hyperthemia may modify acute and chronic responses to radiation exposure. Current physical data are not adequate to define the radiation environment in space, especially in estimating solar flare intensities and similar phenomena. Relatively realistic radiation protection guides are proposed, which are tentative, pending additional experimental information on several biological parameters. (Author's abstract, modified)

1673
Laplane, R.,
J. Bernard, and E. Lafontaine
[MEASUREMENT OF RADIOACTIVITY ON COMMERCIAL AIRCRAFT] Mesures de radio-activité sur les avions commerciaux.—Revue de médecine aéronautique (Paris), 2 (8): 419-421. Aug.-Sept. 1963. In French.

Various methods of detecting cosmic radiation on high-altitude aircraft are described. The aircraft are routinely checked by portable Geiger counter 4 or 5 times per week, especially in areas in which ionized particles are likely to accumulate. Filters have been installed in the air exchange system to trap dust particles. The radioactive content of the dust is then determined and related with total air passage. After these and other types of radioactive checks, it has been determined that the amount of cosmic radiation does not reach the dangerous level after high-altitude flights. Nevertheless, the use of dosimeters and protective covers for the ground crews should remain in effect.

1674
Lebedinskii, A. V.,
and IU. G. Nefedov
[PROBLEMS OF RADIATION SAFETY OF SPACE FLIGHTS] Problemy radiatsionnoi bezopasnosti kosmicheskikh poletov.—Problemy kosmicheskoi biologii (Moskva), 2: 11-24. 1962. In Russian, with English summary (p. 24).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 9-25. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Three primary sources of radiation in space flight are discussed: (a) primary cosmic radiation, (b) near-Earth radiation belts and possible radiation belts around other planets, and (c) radiation from solar flares. The estimates of doses of irradiation on space flight suggest that the level of natural radiation on Earth may be exceeded by as much as 1,000,000 times. The development of an effective system for radiation protection requires a detailed study of spectral and isotope composition of primary cosmic radiation, solar flares, and radiation belts around the Earth; of the processes of interaction of protons and heavy nuclei with tissues; peculiarities of distribution of ionization along the traces of particles and their relative biological effectiveness; and the combined effects of radiations and other space flight factors. Investigations of this type will enable the development of radiation protection for space flight conditions, methods and systems of dosimetric monitoring of biological effects of radiations, and ways of prophylaxis and therapy of radiation injuries that may occur during flight. (From the authors' summary)

1675
Linke, C. A.,
W. Lounsberry, and V. Goldschmidt
EFFECTS OF MICROWAVES ON NORMAL TISSUES. — Jour. Urol. 88 (2): 303-311. Aug. 1962.

Using a standard physiotherapy microwave generator and director, large areas of necrosis were produced in the abdominal organs of rabbits exposed to this form of radiant electromagnetic energy. The animals tolerated these large areas of necrosis well. Liver parenchymal cells were more sensitive to the effects of microwaves than bile ducts and connective tissue of the portal regions. Renal tubular cells were more sensitive than kidney glomerular and stromal cells. Reflecting aluminum foil appears to adequately shield tissues adjacent to those being exposed. (Authors' summary, modified)

1676
McAfee, R. D.
PHYSIOLOGICAL EFFECTS OF THERMODE AND MICROWAVE STIMULATION OF PERIPHERAL NERVES. — Amer. Jour. Physiol., 203 (2): 374-378. Aug. 1962.

Physiological effects produced in cats, dogs, rabbits, and rats by microwave irradiation (3-cm. radar and 12.2-cm. Microtherm) are duplicated in these animals by heating peripheral nerves with a warm-water or resistance-wire thermode. Identical effects occur when a temperature ranging between 45 and 47° C. is attained by either of these means at a treated peripheral nerve or within tissue rich in peripheral nerve fibers. The response elicited by thermode or microwave stimulation includes arousal reactions, blood pressure and vascular responses, and signs of neurohumoral activity. It is demonstrated that the physiological effect of microwave radiation is a result of thermal stimulation of peripheral nerves which occurs independently of a significant increase in skin temperature or of total body heating. (Author's abstract)

1677
McLaughlin, J. T.
HEALTH HAZARDS FROM MICROWAVE RADIATION. — Western Med., 3 (4): 126-130, 132. April 1962.

Microwaves affect man adversely in at least four ways: (1) by raising tissue temperatures to intolerable levels and causing cellular damage or death; (2) emanation of X-rays from microwave equipment is a danger and one to be guarded against; (3) molecular absorption of microwaves may interfere with cellular physiology in an infinite number of ways; and (4) microwaves, directly as heat, or in some other manner, act as stressors and set off the stress reaction with its undesirable sequelae. Experimental work to date demonstrates the danger of exposure to microwaves of 12.25 cm. A review of the existing literature and the clinical findings (abnormal capillary fragility, clot retraction, bleeding, and purpura) on a group of people exposed to microwaves are included. (Author's summary, modified) (27 references)

1678
Maslenikova, E. M.
[THE EFFECT OF LIGHT EXPOSURE ON RIBOFLAVIN METABOLISM] Vliianie sveshcheniia na obmen riboflavina v organizme. — Voprosy pitaniia (Moskva), 21 (3): 56-61. May-June 1962. In Russian, with English summary (p. 61).

Exposure of rats to ultraviolet irradiation results in changes in the riboflavin metabolism. With low irradiation doses (2 1/2 erythemic doses) the riboflavin level in the blood rises, while its content in the organs remains unchanged. High irradiation doses (9 erythemic doses) produce an opposite effect, the riboflavin content in blood falls while that of the organs tends to rise. Prolonged exposure to sun rays tends to reduce the riboflavin levels in both blood and organs. It appears that exposure to lesser doses of ultraviolet irradiation increases the ability of the tissues to retain riboflavin. A high supply of riboflavin increases the ultraviolet tolerance radiation of the animals. (Author's summary, modified)

1679
Masley, A. J.,
And A. D. Goedeke
COMPLETE DOSE ANALYSIS OF THE NOVEMBER 12, 1960, SOLAR COSMIC RAY EVENT.—In: Life sciences and space research, p. 96-109. Ed. by R. B. Livingston and others. Amsterdam: North-Holland Publishing Co., 1963.

A detailed analysis of the November 12, 1960, solar cosmic ray event is presented as an integrated space flux and dose. Direct measurements were made of solar protons from 10 MeV to 6 GeV. During the double-peaked high energy part of the event evidence is presented for the trapping of relativistic particles in a magnetic cloud. The proton energy spectrum is divided into three energy intervals, with separate energy power law exponents and time profiles carried through for each. Included in the analysis are the results of rocket measurements which determined the spectrum down to 10 MeV twice during the event, balloon results from Fort Churchill and Minneapolis, earth satellite measurements, neutron monitors in New Hampshire and at both the North and South Pole, and riometer results from Alaska and Kiruna, Sweden. A table is given for the average energy and dose for several solar events from Feb. 23, 1956. (Authors' abstract, in part)

1680
Matveev, V. V.,
and A. D. Sokolov.
[DETERMINATION OF INDUCED RADIOACTIVITY IN SPUTNIK-2] Opredelenie navedennoi radioaktivnosti vo vtorom kosmicheskom korablesputnike.—Problemy kosmicheskoi biologii (Moskva), 1: 265-266. 1962. In Russian, with English summary (p. 266).

An attempt was made to assay the residual γ-activity of biological materials carried in Sputnik-2. A GSD-4π scintillation counter was used. It was shown that 15 days after landing the residual γ activity, if at all observed, did not exceed a 10^{-10} radium g. equivalent.

1681
Meahl, H. R.
AN ENGINEER'S POINT OF VIEW ON THE BIOLOGIC EFFECTS OF MICROWAVE RADIATION. —— Arch. Physical Med. and Rehabilitation, 43 (6): 304-305. June 1962.

A brief discussion is given of the possible dangers from exposure to microwave radiation. A list is given of previous observations that found biologic effects of microwaves. These include cataract formation, growth stimulation in chick embryos, confused behavior in flying birds, and subjective effects in man. It is suggested that there may be healing effects applicable in medicine to be found if enough research can be stimulated.

1682
Meyer, A. F.
RADIOLOGIC HAZARDS AFFECTING THE UNITED STATES AIR FORCE —— Jour. Occupational Med., 4 (5): 258-261. May 1962.

Among the potential sources of exposure of Air Force personnel to ionizing radiation are the following: (1) components of nuclear weapons, (2) industrial radiography, (3) static eliminators, (4) luminescent markers, (5) reactors, (6) diagnostic and therapeutic medical uses, (7) industrial tracer and measurement procedures, (8) calibration of disaster control and post-attack survival instruments, (9) disaster operations, and (10) microwave generating equipment. Consideration is given to incorporation of a radiologic health protection program into the existing Air Force medical service which would apply the basic principles of personnel selection and periodic medical examination, design environmental controls and continuous environmental evaluation, and educate personnel concerning the potential occupational hazard.

1683
Michaelson, S. M.,
R. A. E. Thomson, and J. W. Howland
THERMAL RESPONSE IN THE DOG EXPOSED TO MICROWAVES [Abstract]. —— Physiologist, 5 (3): 182. Aug. 1962.

The thermal response of the dog exposed to 165 mw./cm.^{2}, 2880 Mc., pulsed microwaves is characterized by an increase in rectal temperature followed by a period of stabilization above normal. A secondary rapid increase in rectal temperature occurs, which may be followed by collapse and death of the animal if exposure is prolonged. Insensible water loss is an accurate index of exposure. Repeated exposures to microwaves result in greater tolerance that resembles thermal adaptation. Hydration, alteration in environmental temperature, premedication with central nervous system depressants or previous exposure to ionizing radiation influence the thermal response and sensitivity. (Authors' abstract)

1684
Miller-Milinska, A.,
and R. G. Staricco
QUANTITATIVE RESPONSE OF THE MELANOCYTES TO ULTRAVIOLET LIGHT.—Jour. Investigative Dermatol., 41 (1): 7-8. July 1963.

Male and female subjects between 20 and 60 years of age had a limited area of the back exposed daily to increased amounts of ultraviolet light, up to ten minutes, until a defined pigmentation was observed. A numerical analysis of the melanocytes obtained by biopsy before and after irradiation revealed a decrease in number of melanocytes after exposure, associated with an increase in the size of the cells.

1685
Miro, L.
[HEMATOLOGICAL MODIFICATIONS AND CLINICAL DISORDERS OBSERVED IN PERSONNEL EXPOSED TO RADAR WAVES] Modifications hématologiques et troubles cliniques observés chez le personnel exposé aux ondes émises par les radars. —— Revue de médicine aéronautique (Paris), 1 (4): 16-17. July-Aug. 1962. In French.

A comparative clinical and hematological study was made of 69 persons working or living continually near radar fields, and of 36 persons working 2-6 hours daily with radar. No person in the second group showed signs of any clinical disorders.

However, among the first group, 25 (36.2%) revealed complete absence of clinical disorders, 17 (24.6%) the presence of disorders not related to radar waves, and 21 (30.4%) disorders caused by the high frequency of radar waves. These latter disorders included asthenia, unexplained weakness, febril episodes with shivering and sweating, nausea with or without vomiting, headache, vertigo, syncope, and behavior changes. Six out of 7 cases (8.7%) acquired a neurovegetative syndrome which required hospitalization in two cases. Hematological studies revealed that erythrocyte numbers, hematocrit levels, and hemoglobin counts had remained normal. Most of the subjects demonstrated a significant increase in hemolytic erythrocyte resistance.

1686
Mirutenko, V. I.
[STUDY OF THE LOCAL THERMAL ACTION OF 3 CM. ELECTROMAGNETIC WAVES ON ANIMALS] Vyvchennia mistsevoi teplovoi dii elektromagnitnykh khvyl' dovzhynoiu 3 cm na tvaryn. —— Fiziologichnyi zhurnal (Kyiv), 8 (3): 382-389. May-June 1962. In Ukrainian, with English summary (p. 389).

The thermal effect of electromagnetic waves of 3 cm. wave length was investigated in rats. The effect of a 1- to 3-minute exposure increases linearly in time for the intensity range of 0.1-0.35 w/cm.^{2}. The energy is absorbed in the upper three millimeters of the subcutaneous tissues.

1687
Nesterov, V. E.,
N. F. Pisarenko, I. A. Savenko, and P. I. Shavrin
[IONIZING RADIATION AT ALTITUDES OF 180-340 KILOMETERS AND RADIOLOGICAL SAFETY DURING FLIGHTS OF SPACESHIPS] Ioniziruiushchie izlucheniia na vysotakh 180-340 km i radiatsionnaia opasnost' pri poletakh kosmicheskikh korablei-sputnikov.—Problemy kosmicheskoi biologii (Moskva), 2: 170-191. 1962. In Russian, with English summary (p. 190-191).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 179-202. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The experimental results are presented of ionizing radiation measured at 180-340 kilometers altitude during the flights of the Russian space ships II and III. The average dose absorbed was 8.4 mrad per day (during the flight through radiation belts at the height of 320 km. it amounted to 40 mrad per day), which is considered not dangerous for the cosmonaut. During very long flights at altitudes of 200-300 km. only solar cosmic rays appearing during chromospheric bursts constitute a radiation hazard. The primary nuclei of cosmic radiation can cause rare but specific biological effects not observed at sea level.

1688
Ōide, R.,
and H. Hōrai
[FATAL DOSAGE OF MICROWAVES TO THE MOUSE AND BODY TEMPERATURE INCREASE DURING EXPOSURE] [Abstract]. —— In: Abstracts of the 7th Meeting of the National Defense Medical Society. Bōei Eisei (National Defense Medical Journal) (Tokyo), 9 (3): 75. March 1962. In Japanese.

At each of five levels of microwave exposure (18.2 to 53.8 milliwatts/cm.^{2}) five mice were measured for their deep body temperature. At 27.1 milliwatts/cm.^{2} the body temperature rose 5.1° C., while at the next level of 36.0 milliwatts/cm.^{2} it rose an average of 19.5° C. At the former level there was one fatality, and at the latter level 4 fatalities occurred. With 44.9 milliwatts/cm.^{2} and above all the mice were killed. It appeared that a suppression of body temperature increase by the animal occurred at the lower dosages. A discussion is included.

1689
Ostachowicz, M.
[RESULTS OF OCULAR EXAMINATION OF RABBITS IRRADIATED BY RADAR WAVES] Wynik badania oczu królików napromienionych falami radarowymi.—Lekarz wojskowy (Warszawa), 39 (1): 9-15. 1963. In Polish, with French summary (p. 15).

Eighteen rabbits, in three groups of six animals, were irradiated by microwaves similar to those produced in radar installations. The animals were irradiated for a total of 80 hours, during 63-81 days. Radar exposures lasted from 1-11 hours with several days interruption. Two groups of rabbits were irradiated by waves 10 cm. in length having a field intensity of 4 microwatts/cm^2; the third group, by waves 3 cm. in length having a field intensity of 0.3 microwatts/cm^2. Following irradiation, the animals were examined with an ocular speculum and a biomicroscope. No ocular pathological changes were found.

1690
Parfenov, G. P.
[INCIDENCE OF DOMINANT LETHAL MUTATIONS IN DROSOPHILA MELANOGASTER DURING SPACE FLIGHT ON SPUTNIK] Vozniknovenie dominantnykh letal'nykh mutatsii u Drosophila melanogaster pri kosmicheskom polete na korable-sputnike.—Problemy kosmicheskoi biologii (Moskva), 1: 232-235. 1962. In Russian, with English summary (p. 235).

A total of 800 males of Drosophila melanogaster of the wild line D-32 were carried on Sputnik-2 on its orbital flight. No increase of dominant lethal mutations was observed in the spermatozoa; in the spermatid stage, however, a statistically significant increase in the number of mutations (2.56 ± 0.63%) occurred. Since spermatids are known to be sensitive to radiation, it is assumed that the change in mutation frequency was due to cosmic radiation.

1691
Pasinetti, A.,
and L. E. Pasinetti
[ASTROPHYSICAL AND RADIOBIOLOGICAL ASPECTS OF HUMAN SPACE FLIGHT] Aspetti astrofisici e radiobiologici del volo umano nel cosmo. —— Rivista di medicina aeronautica e spaziale (Roma), 25 (3): 466-499. July-Sept. 1962. In Italian, with English summary (p. 496).

The astrophysical characteristics, origin, and distribution are discussed of ionizing, solar, cosmic, and Van Allen radiations found in space. Calculations are given of the dosage for cosmic radiations affecting both the interior and exterior of a space vehicle traveling through the Van Allen belt. Consideration is given to the reduction of the radiation dose by biological shielding and the cutaneous lesions caused by protons and weak and ultra-short X-photons. Radioprotection of pilots by means of drugs (i.e., sulfhydryl compounds) administered parenterally about half an hour prior to radiation exposure is suggested.

1692
Payne, R. B.
EFFECTS OF ACUTE RADIATION EXPOSURE ON HUMAN PERFORMANCE.—School of Aerospace Medicine, Brooks Air Force Base, Tex. Aeromedical Review no. 3-63, Feb. 1963. 27 p.

More than fifty studies of anthropoid behavior observed under various kinds, and amounts of ionizing radiation have shown, on balance, that behavioral functions are highly resistant to acute whole-body doses well above those required to produce troublesome manifestations of acute radiation sickness. Despite this overwhelming evidence of resistance, however, several aspects of behavior are clearly not impregnable. Further effort, therefore, is required to relate such aspects both to the physical dimensions of the radiation environment and the visible damage produced in biologic tissues, with particular emphasis on the modifying properties of other stressors. In terms of immediate effects, present knowledge suggests the acute radiation syndrome as the ruling factor in the specification of permissible acute exposure levels. (From the author's summary) (55 references)

1693
Pol, W.
[EFFECT OF MICROWAVES EMITTED BY A RADAR POST ON CATARACT FORMATION] Zagadnienie wpływu mikrofal emitowanych z nadajników radarowych na powstawanie zaćmy. —— Lekarz wojskowy (Warszawa), 38 (4): 318-327. 1962. In Polish, with French summary (p. 327).

A review is presented of the literature dealing with changes in the crystalline lens following microwave irradiation. The results show that short microwaves cause opacities on the anterior lens surface, and long microwaves on the posterior surface. Appearance of these opacities is favored by the presence of diabetes and by the decrease of lens enzymes following irradiation. (Author's summary) (26 references)

1694
Prausnitz, S.,
and C. Susskind
EFFECTS OF CHRONIC MICROWAVE IRRADIATION ON MICE.—IRE Trans. Bio-Med. Electronics, BME-9 (2): 104-108. April 1962.

Two hundred males were exposed daily for 59 weeks to microwave radiation (0.100 watts/cm^2) for four and one half minutes. This treatment produced an average body temperature rise of 3.3° C. Changes in body weight, in body temperature response to heating, and in the blood picture were not evident. Testicular degeneration in the form of tubule atrophy and neoplasms of the white cells were found histologically. Longevity of the mice did not appear to be affected. (Authors' summary, modified)

1695
Presman, A. S.,
and N. A. Levitina
[NONTHERMIC ACTION OF MICROWAVES ON THE RHYTHM OF CARDIAC CONTRACTIONS IN ANIMALS. I. INVESTIGATION OF CONTINUOUS MICROWAVE ACTION] Neteplovoe deistvie mikrovoln na ritm serdechnykh sokrashchenii u zhivotnykh. I. Issledovaniia deistviia nepreryvnykh mikrovoln. —— Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 53 (1): 41-44. Jan. 1962. In Russian, with English summary (p. 44).

Various body parts of rabbits were irradiated with microwaves of nonthermic intensity (wave length, 12.5 cm.; intensity, 7-12 milliwatt/cm.^{2}). A "chronotropic" effect of microwaves on the heart sinus rhythm was observed during irradiation for 20 minutes and immediately after it (10 min.). Irradiation of ventral body surfaces tended to slow the rhythm, while irradiation of the dorsal part of the head tended to accelerate it. The former effect of microwaves is attributed to reflex autonomic reactions provoked by direct action of microwaves on the superficial reflexogenic zones, while the latter effect is brought about by microwave action on the brain cells.

1696
Rapoport, I. A.,
and A. V. Miller
[THE MUTATIONAL ACTIVITY OF ANTI-PARTICLES] Mutatsionnaia aktivnost' antichastits.—Problemy kosmicheskoi biologii (Moskva), 2: 359-369. 1962. In Russian, with English summary (p. 369).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 369-379. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Mutational effects of positrons on *Drosophila melanogaster* were explored. Positrons have been identified in cosmic ray showers and as products of disintegration of heavy particles. The positrons emitted by Cu^{62} cause recessive lethal mutations, fragmentation of the chromosomes containing sex-linked genes and nondisjunction of microchromosomes at a rate approximating that of electrons and X-rays in the same dose. Positrons in combination with electrons cause recessive lethal mutations in the offspring and sterility in irradiated insects corresponding quantitatively to that produced by similar ionization doses of electrons and X-rays. The mutation yield curve is similar to that of elementary particles that are not "anti-matter". A study of the principal genetic effects reveals nothing specific in the action of the positrons. In calculating the total genetic effect of mixed radiation involving anti-particles, the latter probably can be added to the main component of elementary particles with differential consideration of their energy and half-life.

1697
Rapoport, I. A.,
S. P. Iarmonenko, and G. A. Avrunina
[THE EFFECT OF HIGH ENERGY PROTONS ON THE RATE OF OCCURRENCE OF MUTATIONS] Vliianie protonov vysokikh energii na chastotu vozniknoveniia mutatsii.—Problemy kosmicheskoi biologii (Moskva) 2: 370-387. 1962. In Russian, with English summary (p. 386-7).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 380-396. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Protons with energies of 660 Mev in doses of 510-12,140 rads cause an increase in recessive lethal mutations in the sex chromosomes of Drosophila melanogaster at a rate which is proportional to the dose, i.e., about a 2% increase for every 1000 rads. With respect to its course and absolute mutation yield the obtained curve is similar to that yielded by gamma rays in the same doses. Determination of the rate of recessive lethal mutations for 3980 r, 9165 r, 10745 r, 11485 r, 12140 r during five or six passages at 5-day intervals reveals a sharp fall in the mutation yield of irradiated spermatogonia as compared to irradiated spermatozoids. The comparison of fertility in the first generation of crossed males irradiated with different proton doses gives evidence about the dominant lethals in irradiated spermatozoa which resembles the distribution of dominant lethal mutations induced by X and gamma-rays. Mutation with complete or semisterility resembles the distribution of other types of mutations. In addition to the effect of high-energy protons molecular oxygen constitutes a more important component of the mutagenic background than organic peroxides and radicals.

1698
Saksonov, P. P.,
V. V. Antipov, and N. N. Dobrov
[SOME RESULTS AND NEW AIMS IN THE FIELD OF COSMIC RADIOBIOLOGY] Nekotorye itogi i zadachi v oblasti kosmicheskoi radiobiologii.—Vestnik Akademii meditsinskikh nauk SSSR (Moskva), 18 (8): 13-29. 1963. In Russian, with English summary (p. 20).

Data on cosmic radiation are reviewed in connection with the possibility of longer space flights. The main problems to be resolved are: the relative biological effectiveness of individual components of cosmic radiation, the proportional share of cosmic radiation in the total set of hazardous factors in space flight, research on the basic principles and the application of these to finding adequate means of physical and pharmacological protection of man and the entire biosystem, and the elaboration of methods for physical and biological dosimetry.

1699
Salati, O. M.,
A. Anne, and H. P. Schwan
RADIO FREQUENCY RADIATION HAZARDS. — Electronic Industries, 21 (11): 96-101. Nov. 1962.

The known harmful effects of excessive electromagnetic radiation are thermal in nature, and a rise in body temperature greater than 1° C. is intolerable. In analyzing the amount of radiation that the body can withstand, consideration is given to the amount of heat that the body can dissipate, the dosage rate, and the duration of exposure to radiation. Experimental work on homogeneous doll phantoms gave values of relative absorption of 50-60%. This indicates that a three-layered phantom more closely resembling man would give higher values, perhaps in the region of 50-125% as previously predicted theoretically. It is concluded that adult man will absorb 50-125% of the incident energy in the frequency range of biological interest (300 megacycles to 10 gigacycles) and particular values in this range will depend on frequency, thickness of skin, and subcutaneous fat. Tabulations and graphs are presented of the electrical properties of biological tissues, the relative absorption cross section of dolls and doll parts, and the effect of the size parameter and thickness of fat layer at 400 megacycles, 2.88 gigacycles, and at 10 gigacycles.

1700
Savenko, I. A.,
N. F. Pisarenko, and P. I. Shavrin
[SPACE FLIGHTS AND THE RADIATION HAZARD] Kosmicheskie polety i radiatsionnaia opasnost'. — Priroda (Moskva), 1962 (2): 40-48. Feb. 1962. In Russian.

The following topics are discussed: measurement of radiation dosage in rads, cosmic radiation at the Earth's surface and at low altitudes, the effect of solar radiation on primary cosmic radiation, the radiation belts of Earth, radiation from solar flares, and radiation measurements made on board the second and third Soviet satellites in August and December 1960. The maximum permissible dose in the USSR for individuals working with radioactive materials and ionizing radiation sources is 0.1 rems/working week. In 1959, which was a period of intense solar activity, the magnitude of the flux of primary radiation particles in space was established as 2 particles/cm.^{2}/sec. behind a 1 g./cm.^{2} thick shield, resulting in 15 mrads/24 hrs. A third radiation belt was discovered approximately 50-60,000 km. from the Earth's center, but because of the low energy of its particles (a few hundred ev) it does not constitute a radiation hazard. Shielding provides sufficient protection from the outer radiation belt, but is not adequate for protection from the inner radiation belt, therefore this zone should be avoided. The main radiation hazard, however, is from the infrequent solar flares. A special well-shielded cabin should be provided for retreat during a flare, or it should be possible to terminate the space flight in time to avoid the flare.

1701
Saylor, W. P.,
D. E. Winer, C. J. Eiwen, and A. W. Carriker
SPACE RADIATION GUIDE. — American Machine and Foundry Co., Alexandria, Va. (Contract AF 33(616)-7631); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7165, Task no. 716503). Technical Documentary Report no. AMRL-TDR-62-86, Aug. 1962. xiii+210 p.

The Space Radiation Guide is intended to be a reliable, easily understood handbook that will provide the reader with sufficient knowledge of the nature of space radiations to permit him to comprehend the total space radiation problem as it pertains to the hazards of manned space flight. The report is not intended to provide answers to all the problems, but, instead, to present much of the factual data currently known and to point out areas where information is sketchy and inconclusive. The radiations considered are cosmic rays, solar radiation, and the geomagnetically trapped (Van Allen) radiations. Included are chapters on instruments used for measuring these radiations, on shielding techniques, and on biological effects. (Authors' abstract) (34 references)

1702
Schaefer, H. J.
LET ANALYSIS OF TISSUE IONIZATION DOSAGES FOR PROTON RADIATIONS IN SPACE. —— Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-1002, Subtask 1). Report no. 21, Feb. 19, 1962. ii+13 p.

Earlier computations of the distribution of the ionization dosage within a spherical tissue phantom of 30 cm. diameter behind three different shield thicknesses for exposure to flare-produced and Van Allen Belt protons are amended by a separate evaluation of the dose fraction produced at a Linear Energy Transfer (LET) exceeding 40 kev/micron. For the first radiation, this fraction is always smaller than 2% and for the second smaller than 0.5%. Separate determination of the two fractions seems advisable for assessment of the net exposure status and estimates of late effects, since damage from radiation of high LET is nonrecoverable. (Author's abstract)

1703
Schaefer, H. J.
TIME PROFILE OF TISSUE IONIZATION DOSAGES FOR BAILEY'S SYNTHETIC SPECTRUM OF A TYPICAL SOLAR FLARE EVENT. —— Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-1002, Subtask 1). Report no. 22, April 4, 1962. ii+9 p.

Bailey's set of spectra describing development and decay of a typical flare-produced solar particle beam, based on comparative evaluation of radar observations of polar cap absorption events and direct measurements with high altitude vehicles, is evaluated in terms of tissue dose rates and integral dosages within a spherical tissue target behind different shielding. For light shielding a maximum instantaneous dose rate of 4.7 r/hr. and an integral dose of 200 r for the total duration of 64 hours are obtained. Tables and graphs show the complex changes occurring during build-up and decay of a flare event. (Author's abstract)

1704
Schaefer, H. J.
A NOTE ON THE INFLUENCE OF NUCLEAR COLLISION ON THE RADIATION DOSE FROM FLARE PRODUCED PROTONS IN SPACE. —— Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-1002, Subtask 1). Report no. 23, Sept. 24, 1962. ii+11 p.

Assessment of the contribution to the tissue dose in a human target from nuclear collisions in the shield and/or inert material of a space ship exposed to flare-produced protons requires extremely complex computational procedures. An approximation method of determining an upper limit for this contribution is described which assumes that all energy removed from the primary beam is exclusively scattered in forward direction. Application to Bailey's energy spectrum of a typical large flare event shows that the depth dose pattern is not significantly different from the one obtained in an earlier study which considered only ordinary ionization. In fact, at greater depth the former model furnishes slightly higher doses because it disregards the attenuation of the primary beam due to nuclear collisions. The suggested method seems of general usefulness for preliminary estimates before engaging in a full scale computational analysis. (Author's abstract)

1705
Schaefer, H. J.
LET SPECTRUM AND RBE OF HIGH ENERGY PROTONS.—In: Proceedings of the symposium on the protection against radiation hazards in space (Gatlinburg, Tenn., Nov. 5-7, 1962), book 1, p. 393-401. U. S. Atomic Energy Commission, Washington, D. C., Report no. AEC-TID-7652.

High-intensity proton radiations in space temporarily super-imposed upon the ordinary cosmic ray beam have energy spectra extending from a few to many hundred Mev. Analysis of the Linear Energy Transfer (LET) spectrum of a typical flare-produced proton beam shows that the bulk of the energy dissipation is effected with an LET spectrum closely resembling that of standard X-rays. A basic difference exists in the spectral region beyond 10 kev/micron tissue. Though the fractional dose in that region expressed in rad remains on the level of a few per cent, it represents a significant though not a major part of the total rem dose. It is suggested that both dose fractions be treated separately in assessing the ERD (Equivalent Residual Dose) with the recovery allowance of 2.5% per day applicable only to the low LET fraction.
(Author's abstract)

1706
Schaefer, H. J.
ENERGY DISSIPATION CHARACTERISTICS IN TISSUE FOR PROTON RADIATION IN SPACE. I. COMPARATIVE ANALYSIS OF THE LET SPECTRA OF MONOENERGETIC, FLARE PRODUCED, AND FISSION NEUTRON RECOIL PROTONS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-1002, Subtask 1); and National Aeronautics and Space Administration, Washington, D. C. (Order no. R-75). Report no. 24, Jan. 24, 1963. ii+15 p.

Based on the definition of local energy dissipation as produced by collisions transferring less than 100 e-volts, the linear energy transfer (LET) spectra of flare produced and neutron recoil protons from thermal fission are established and compared to the corresponding spectrum of standard X-rays. A striking similarity is obtained between the spectra of flare protons and of X-rays whereas the recoil proton spectrum is basically different, centering heavily on LET values about and above 10 kev/micron tissue. In the latter LET interval, flare protons dissipate only a few per cent of their total energy. This indicates that the bulk of the ionization dosage from flare protons should be assigned the relative biological effectiveness (RBE) of 1.0 with only a fraction requiring elevated RBE values. (Author's abstract)

1707
Schaefer, H. J.
A NOTE ON THE INFLUENCE OF SHIELD GEOMETRY ON AIR DOSE AND TISSUE DOSE FROM PROTONS WITHIN A SPACE VEHICLE.— Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-1002, Subtask 1); and National Aeronautics and Space Administration, Washington, D. C. (Order no. R-75). Report no. 25, April 25, 1963. ii+15 p.

For three typical space radiation proton spectra assuming 4 pi incidence the effect of shield geometry on the distribution of air dose within a spherical shell of uniform wall thickness and within a conical vehicle with a heavy heat shield at the base is analyzed theoretically. Highly structured dose patterns are obtained even for the completely symmetrical spherical vessel. Comparative analysis of the depth dose distribution in a tissue phantom of 30 cm. diameter at two different locations in the conical vehicle shows that greatly different tissue doses can prevail at locations which show equal air doses. It is concluded that the tissue dose in the body of the astronaut cannot be accurately inferred from stationary radiation sensors, but requires instruments carried on the body. (Author's abstract)

1708
Shinowara, G. Y.,
and A. Horava
THE BIOLOGICAL ACTION OF ULTRAHIGH FREQUENCIES. —— I.C.R.S. Med. Reports, 4 (3): 5-13. July-Sept. 1962.

This is a review of a Russian publication (by several authors) on the biological effects of ultrahigh frequencies [microwave radiation] issued by the Academy of Medical Sciences USSR in 1960. The most significant conclusion reached is that there is a wide difference between the Russian and American views on the maximum permissible daily UHF irradiation in man. The Russians recommend 0.01 milliwatts/sq. cm., one tenth of that at which non-thermal UHF effects appear. The general Western recommendation is 10 milliwatts/sq. cm. The former value is based on clinical findings after brief intensive or prolonged low-intensity exposure (fatigue, headaches, hypotension, and bradycardia of central nervous origin, frequently associated with sinus arrhythmia, increased uptake of radioactive iodine without the clinical symptoms of hyperthyroidism, increased blood histamine level, decreased olfactory sensitivity, and ocular changes). The experimental findings on animals corroborate the basic clinical observations on the non-thermal biological action of UHF. The lack of certain data on the Russian UHF equipment is deplorable as it precludes a more detailed interpretation and comparison of their findings.

1709
Slater, A. E.
AVOIDING THE RADIATION BELT.—In: Space research and technology, p. 35-37. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

The hazards of the van Allen radiation belt are discussed and attention is drawn to the fact that once every day the ecliptic is inclined 35° to the magnetic equator. This inclination provides the possibility of making interplanetary journeys without passing through the dangerous zone by a suitable choice of launching time. Four suggested ways of counteracting the obvious hazards of proton bombardment are: (1) the proper launching time; (2) a ring of shielding maintained in a plane at right angle to the magnetic lines of force (which would alleviate heavy, cumbersome, complete shielding of travelers since all protons move in this plane); (3) a coil around the vehicle to create a small-scale dipole field to turn away incident radiation; and (4) the launching of artificial satellites to absorb the protons which move at high velocity along spiral paths within the belt.

1710
Smurova, E. I.,
T. Z. Rogovaia, S. A. Troitskii, N. S. Lashchenko, and N. D. Mel'nikova
[PROBLEMS OF OCCUPATIONAL HYGIENE AND HEALTH STATUS OF OPERATORS EXPOSED TO THE EFFECTS OF HIGH-FREQUENCY CURRENTS] Voprosy gigieny truda i sostoianie zdorov'a rabochikh na uchastkakh primeneniia tokov vysokoi chastoty. —— Gigiena truda i professional'nye zabolevaniia (Moskva), 6 (5): 22-28. May 1962. In Russian, with English summary (p. 27-28).

Nervous tension and health status were studied in operators exposed to high-frequency fields of the medium-range band. The electrical component tension of the field fluctuated within the limits of 5-100 v/m., that of the magnetic one from 0.2 to 38 a/m. Prolonged action of high-frequency fields evokes disorders of the nervous system in the form of an asthenic syndrome against a background of vegetative dystonia. Vasomotor disturbances are indicated by hypotonia, oscillograms of the smooth type, asymmetry in the amplitude of oscillations and blood pressure. Electrocardiography disclosed sinus arrhythmia and sinus bradycardia, disturbed conduction, and alterations in the terminal portion of the ventricular complex. The leucocyte composition revealed changes among monocytes and lymphocytes, indicating a depression of the reticuloendothelial system. (Authors' summary, modified)

1711
Snell, R. S.
THE CHANGES PRODUCED BY INFRA-RED IRRADIATION IN MELANIN PIGMENTATION OF THE SKIN.—Brit. Jour. Dermatol. (London), 75 (2): 71-78. Feb. 1963.

Guinea pigs were treated with infra-red irradiation of wave-lengths between 15,000 and 100,000 Å for five minutes daily, five days a week for four weeks. This produced an increase in the amount of free melanin in the epidermis with a reduction in the amount of melanin within the melanocytes of the basal layer. Melanocyte counts were significantly increased but not as much as after ultraviolet irradiation. (Author's summary)

1712
Snyder, W. S.
SOME DATA ON THE RELATIONSHIP OF RBE AND LET.—In: Proceedings of the symposium on the protection against radiation hazards in space (Gatlinburg, Tenn., Nov. 5-7, 1962), book 1, p. 402-408. U. S. Atomic Energy Commission, Washington, D. C., Report no. AEC-TID-7652.

The relative biological effectiveness (RBE) of one radiation with respect to a standard radiation is usually defined as the inverse ratio of doses required to produce the same degree of a specified biological effect. It is well known that the RBE depends not only upon the quality of the radiations but also upon such conditions of exposure as dose rate, fractionation of dose, strain and condition of animals, and the biological effect studied. This paper analyzes some experimental data to obtain an indication of the dependence of RBE on linear energy transfer (LET). The cases considered include some experimental studies of effects on cells and on mice. The interpretation of such data for certain conditions of exposure in space is discussed in a preliminary way. (Author's abstract)

1713
Sokolov, IU. L.,
and A. V. Gurskii
[THE PROBLEM OF EXPERIMENTAL STUDY OF THE EFFECT OF SPACE RADIATION CONDITIONS ON HIGHER PLANTS] K voprosu ob eksperimental'nom izuchenii vliianiia kosmicheskogo radiatsionnogo rezhima na vysshie rasteniia.—Problemy kosmicheskoi biologii (Moskva), 2: 164-169. 1962. In Russian, with English summary (p. 169).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 173-178. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The spectral distribution of the intensity of solar radiation in the Pamir mountains is described. At 2,500-4,500 m. altitude there is present an intense ultraviolet radiation of 290-315 millimicra wavelength. The intensity of the long-wave spectrum is similar to that found at the limits of the Earth's atmosphere, therefore it is possible to simulate space radiation conditions with supplementary lighting, using ultraviolet rays between 240-270 millimicra. Experiments show that plants adapt themselves rather well to such an articifical light regime. Photoreactivation is considered to be the process which protects the plants against injury through large doses of short-wave ultraviolet.

1714
Stubbs, P.
HOW RISKY IS SPACE TRAVEL ?—New Scientist (London), 16 (313): 376-377. Nov. 15, 1962.

A report is given of some of the data and ideas presented at the recent international symposium in Paris on the basic environmental problems of man in space. The problems of radiation and weightlessness which present the greatest risk are discussed from the point of view of source of radiation, type, maximum energy, and dosage levels for future space flights. Of the various types of radiation that which comes from the periodical solar flares is considered to be the most dangerous due to their high radiation dose, the impossibility to protect astronauts, and the unpredictability of their occurrence. The Russians presented figures showing that travelers on a week's trip to the Moon have about a 20% chance of annihilation. Occurrence of flares is linked to an 11-year cycle of solar disturbance. The American Moon project is evidently not aimed at landing on the Moon during years of minimum disturbance. Some of the effects of weightlessness on Russian astronauts, especially vestibular changes, are further clarified. In general it appeared that weightlessness would not provide any major handicaps.

1715
Tobias, P. R.
THE EFFECTS OF RADIATION ON INTEGRATED BEHAVIOR.—In: Unusual environments and human behavior, p. 395-417. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

The present review of the effects of ionizing radiation on integrated behavior leaves little doubt that sublethal and very small doses (milliroentgens) alter selected aspects of animal and human behavior. Further, there is little doubt that man venturing into space will be exposed to radiation at or beyond these levels. From the studies reported, since even the smallest dose involves great energies (million electron volts), there will be some effect on organ systems if the measurement instrument is sensitive enough. In order to develop realistic standards for exposure, the types of dose effects, rate of exposure, type of radiation involved, and several other variables have to be specified. (Author's summary, in part) (32 references)

1716
Tromp, S. W.
POSSIBLE EFFECTS OF POLARIZED LIGHT.—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 349-350. Amsterdam: Elsevier Publishing Company, 1963.

Polarized light plays a significant role in the orientation of many lower animal organisms and birds. At this point nothing is known about its physiological significance for the human body.

1717
Vasil'ev, G. A.,
and V. A. Beliaev
[ON THE PROTECTIVE ACTION AGAINST X-RAYS OF ADAPTATION TO HYPOXIA IN COMBINATION WITH ACUTE HYPOXIA] O zashchitnom deistvii ot rentgenovskikh luchei akklimatizatsii k gipoksii pri sochetanii s ostroi gipoksiei.—Radiobiologiia (Moskva), 3 (1): 117-120. 1963. In Russian.

Four groups of mice were subjected to X-ray doses of 600 r. Two groups, previously adapted to hypoxia, were used in the experiment. The first group was irradiated with X-rays while being kept in a normal atmosphere, the second in an atmosphere containing 10-12% oxygen (acute hypoxia). Two groups of normal (unadapted) mice served as controls: one was irradiated under normal conditions, the second while exposed to hypoxia. It was found that oxygen consumption increased with adaptation to hypoxia, and remained higher than in the controls, after X-ray irradiation. This effect was observed equally in both test groups. In animals in acute hypoxia the oxygen consumption dropped both prior to and after irradiation. Oxygen consumption after irradiation increased unevenly, with a maximum being attained 7-12 minutes after exposure. It is concluded that the protective effect of hypoxia adaptation is significantly enhanced when combined with acute hypoxia.

1718
Waddington, C. J.
THE HAZARD OF CORPUSCULAR SOLAR RADIATION TO MANNED SPACEFLIGHT. — Jour. Brit. Interplanetary Soc. (London), 18 (7): 277-280. Jan.-Feb. 1962.

The occurrence of storms of solar particles represents a considerable hazard to manned space flight. While it appears to be possible to provide adequate protection against the effects of Class A storms (not detected at sea level except by riometers) without incurring an excessive weight penalty, protection against Class B storms (detectable at sea level) hardly seems feasible. It seems likely that it will be necessary to accept, as an unavoidable hazard, the risk that such a storm will occur during a flight. For expeditions to the Moon this risk is probably acceptable, since Class B storms occur rather infrequently. For flights to more distant objects, such as Mars or Venus, the odds in favor of the astronaut will drop sharply, and the probability of a failure owing to encountering a storm will become comparable to the other possible causes of failure. The radiation dose that may be received by astronauts shielded by different thicknesses of material is computed from the presently available data on solar storms. (Author's summary, modified)

1719
Yagoda, H.
RADIATION STUDIES IN SPACE WITH NUCLEAR EMULSION DETECTORS. — Space Sci. Reviews (Dordrecht-Holland), 1 (2): 224-277. Oct. 1962.

Recent techniques of transatmospheric exposure using nuclear emulsions are reviewed. The recording medium of the nuclear emulsion technique is compact, rugged, adaptable to the diverse shapes and dimensions of the recovery capsule, and requires no power for its operation. It has the ability to record and discriminate the entire gambit of charged particles, traveling at both low and relativistic velocities, from the electron to completely stripped iron nuclei. This versatility makes the emulsion an invaluable tool for exploratory work on the interplanetary radiations and the unknown phenomena which may be still awaiting discovery as deeper probes are made into space. The emulsion technique, geometric aspects of the exposure mechanism, and emulsion development are presented as well as studies of star production, proton ender frequencies, the heavy primary component, composition of the inner radiation belt, and future prospects. (93 references)

o. Magnetic and Electric Fields

1720
Becker, R. O.
RELATIONSHIP OF GEOMAGNETIC ENVIRONMENT TO HUMAN BIOLOGY.—New York State Jour. Med., 63 (15): 2215-2219. Aug. 1, 1963.

The magnetic field of the earth is an important physiologic factor for living organisms. It appears that behavioral changes of an undesirable nature, either quite evident or subtle, may result from exposure to environments having lower or higher field strengths than "normal" or those having either no fluctuation or cyclic fluctuation at frequencies other than those to which we are adjusted. Magnetic factors beyond eight earth radii distance must be investigated thoroughly before exposing human beings to such environments. (Author's abstract)

1721
Beischer, D. E.
HUMAN TOLERANCE TO MAGNETIC FIELDS. — Astronautics, 7 (3): 24-25, 46, 48. March 1962.

A review is presented of magnetic effects on humans. A survey is given of personal communications to the author from workers in laboratories where magnetic fields of high intensity are used. From these incidental observations it seems that there are few effects, but more data will have to be gathered before any conclusions are drawn. Experiments on the effects of magnetic fields on lower animals are reviewed and discussed. Various aspects of the earth's magnetic field and the fields found on other planets are given. A suggestion is made that more studies should be done on the effects of the absence of a magnetic field.

1722
Davis, L. D.,
[P. E. Spiegler], K. Pappajohn, and I. M. Plavnieks
BIBLIOGRAPHY OF THE BIOLOGICAL EFFECTS OF MAGNETIC FIELDS. — Federation Proceedings, 21 (5, supplement no. 12): 1-38. Sept.-Oct. 1962.

This bibliography consists of 393 references to papers (books, journal articles, and reports) published from 1843 to March 1962. Few of the early papers are included. The paramagnetic and diamagnetic effects are restricted to biological substances and living organisms. Entirely omitted are papers dealing with animal "magnetism", "magnetic" healing, and similar topics. The items are alphabetically arranged by first author. Guidance to the basic subject contents is provided by a concise list of standard descriptor terms defining each item with regard to magnetic field characteristics and duration of exposure, biomaterials and level of organization, biological effects of exposure, and practical applications. Column arrangement and typographic differentiation of descriptor terms provide quick and easy scanning of the references according to the principal topical criteria. Each reference is identified as to type and character of treatment, such as: original data, description of apparatus, discussion, review, etc.

p. Posture

1723
Abel, F. L.,
J. H. Pierce, and W. G. Guntheroth
BARORECEPTOR INFLUENCE ON POSTURAL CHANGES IN BLOOD PRESSURE AND CAROTID BLOOD FLOW.—Amer. Jour. Physiol., 205 (2): 360-364. Aug. 1963.

The effects of 30° head-down and head-up tilting on mean systemic blood pressure, carotid blood flow, and heart rate were studied in 16 dogs under morphine and Nembutal anesthesia. The tilting procedure was further repeated after denervation of the carotid sinus and aortic arch baroreceptors and after administration of a dihydrogenated ergot alkaloid mixture (Hydergine). The results indicate that the drop in pressure in the head-down position is primarily due to baroreceptor activity and that the baroreceptors are necessary for compensatory vasoconstriction on head-up tilting. Carotid blood flow decreased in both tilted positions in the control animals; the possible relationship to cerebral blood flow is discussed. (Authors' abstract)

1724
Abramson, D. I.,
S. Tuck, A. M. Zayas, and R. E. Mitchell
EFFECT OF ALTERING LIMB POSITION ON BLOOD FLOW, O_2 UPTAKE, AND SKIN TEMPERATURE. —— Jour. Applied Physiol., 17 (2): 191-194. March 1962.

Nineteen normal, male subjects were studied. In each instance the limb was placed in three positions: (1) horizontally, at the level of the heart; (2) with the elbow at this level, but with the forearm and hand dependent and forming an angle of 34° with the horizontal; and (3) with the forearm and hand elevated and forming an angle of 34° with the horizontal. No consistent change in blood flow or oxygen uptake was noted when the limb was placed in dependency. In the elevated position there was a small, but significant, reduction in blood flow and oxygen uptake. Cutaneous temperature of the forearm was not affected by either position, while a definite fall in skin temperature was noted in the hand in dependency. These results suggest that variations in position of the upper extremity elicit compensatory vascular mechanisms which tend to counteract the hydrostatic effect on local blood flow and oxygen uptake. (Authors' abstract, modified)

1725
Bouhuys, A.,
and H. J. van Lennep
EFFECT OF BODY POSTURE ON GAS DISTRIBUTION IN THE LUNGS. —— Jour. Applied Physiol., 17 (1): 38-42. Jan. 1962.

Postural changes of functional residual capacity (FRC) and pulmonary nitrogen clearance efficiency were studied in six male subjects placed supine on a tilting table, in head-up, horizontal, and head-down positions. FRC varied linearly with the angle of tilt. The lung clearance index (LCI) increased significantly in the supine and head-down positions, compared to the head-up positions, which indicates less uniform gas distribution in the former postures. This was confirmed by analysis of semilogarithmic graphs of nitrogen washout. Inhalation of epinephrine did not affect the postural changes of FRC and LCI, but caused a small increase of LCI irrespective of posture. The increased uneven distribution in head-down and supine positions is probably a consequence of the lung volume decrease in these postures, and may be explained by mechanical factors such as surface tension, which tend to close lung units when the lungs are deflated. Bronchomotor tone has no appreciable influence on these postural changes in normal subjects. (Authors' abstract)

1726
Caldwell, L. S.
BODY STABILIZATION AND THE STRENGTH OF ARM EXTENSION. —— Human Factors, 4 (3): 125-130. June 1962.

Nine subjects were measured to determine the maximum force of arm extension (push) at five elbow-angles at 25° intervals between 60° and 160°, and with five conditions of back support: no back support, and with a support at 20, 40, 60, and 80 per cent of the distance from the seat to the height of the shoulder joints. It was found that the strength of the response was influenced by the elbow-angle and the degree of body stabilization provided by the backrest. The backrest height had little effect at the lesser elbow-angles, but as the arm was further straightened to 135° or 160° the back support became an important factor in limiting the strength of the response. These results emphasize the importance of both joint angle and body stabilization in the production of usable muscle forces. (Author's summary)

1727
Comalli, P. E.
BODY POSITION AND LOCALIZATION OF A VISUAL OBJECT.—Perceptual and Motor Skills, 16 (1): 86. Feb. 1963

An experiment was performed with 10 subjects to verify an observation that in a dark room a light source directly above the eye level of a supine subject appears to be shifted below the eye level, while a light at eye level directly in front of an erect subject appears to be above eye level. The results fully confirm this observation.

1728
Corso, J. F.
BODILY POSITION AND AUDITORY THRESHOLDS. —— Perceptual and Motor Skills, 14 (3): 499-507. June 1962.

The purpose of the study was to determine the effects of body position on the threshold of hearing for pure tones. Twenty subjects were tested by a modified method of limits at three frequencies (500, 1500, and 3000 c.p.s.) on both right and left ears, with all the subjects being tested in each of 10 bodily positions (standing, sitting upright, sitting tilted 45° to the right side, left side, backward, and forward, and lying on the right side, left side, prone, and supine). The main effects of position, frequency, and subjects were all significant. The position variable produced shifts in the auditory threshold up to

4.5 db. No differences were found when threshold values for "down" ears were compared with those for "up" ears based on four different bodily positions. The results tend to support the general hypothesis of sensory interaction produced by the simultaneous stimulation of the auditory and vestibular modalities. A tentative explanation of the interaction effect is offered in the physiological proximity of the central neural connections of the auditory and vestibular pathways. (Author's summary, modified)

1729
Eisenberg, S.
EFFECT OF POSTURE AND POSITION OF THE VENOUS SAMPLING SITE ON THE HEMATOCRIT AND SERUM PROTEIN CONCENTRATION.—Jour. Lab. and Clinical Med., 61 (5): 755-760. May 1963.

Blood samples were first taken from 25 subjects who had been recumbent for 12 hours before sampling. The subjects then stood for 20 minutes, and a second sample from the standing position was secured. Assumption of the erect posture results in a significant rise in the hematocrit. As there is a dependency of the concentration of the hematocrit on the venous sampling site, the magnitude of the change with standing will vary according to the relation of the site to the right atrium. Each of these changes in hematocrit is associated with a commensurate rise in serum protein concentration, suggesting that protein-poor fluid is escaping from the vascular tree. (Author's abstract, modified)

1730
Klepzig, H.,
and P. Frisch
[ON THE DIASTOLIC STROKE VOLUME RESERVE OF THE HUMAN HEART] Über die diastolische Schlagvolumenreserve des menschlichen Herzens —Arztliche Forschung (München-Gräfelfing), 17 (6): 305-309. June 10, 1963. In German, with English summary (p. 305).

The isolated animal heart increases its stroke volume only by an increased diastolic expansion achieved by an increase of the diastolic afflux. In order to demonstrate whether in humans with a healthy heart an increase in blood afflux may lead, under physiological conditions, to an increase in the heart volume, the changes in heart volume were determined in the following conditions: (1) with the legs raised, and (2) by Müller's aspiration test performed in 10 recumbent subjects. Also, the heart volume was determined in five subjects in the standing and recumbent positions prior to and during the Müller test. A definite increase in heart volume could only be demostrated in standing, but not in recumbent subjects. Apparently the human heart has an optimal filling in the recumbent position. There was no indication of a significant diastolic reserve in stroke volume in recumbent subjects as was the case in standing subjects. (Authors' summary, modified)

1731
Larson, C. P.,
and J. W. Severinghaus
POSTURAL VARIATIONS IN DEAD SPACE AND CO_2 GRADIENTS BREATHING AIR AND O_2. — Jour. Applied Physiol., 17 (3): 417-420. May 1962.

Effects of postural changes on anatomic and physiologic dead space and arterial-alveolar CO_2 gradients were studied in 11 healthy, adult subjects breathing air and O_2. Results indicate that, on moving from the supine to the sitting position, anatomic dead space (V_{ADS}) and physiologic dead space (V_{PDS}) increased by corresponding amounts (42 and 37 ml.) with no increase in alveolar dead space or volume of lung which is nonperfused. Arterial-alveolar CO_2 gradients were unaffected by posture, but more than doubled with O_2 breathing, suggesting that O_2 may relax the pulmonary vascular bed and diminish perfusion of highest lung segments. Isoproterenol aerosol (0.5%) produced significant bronchodilatation (27 ml. increase in V_{ADS}), but only small and inconsistent increases in alveolar dead space and CO_2 gradients. The physiologic dead space/total volume (PDS/V_T) ratio in these subjects while sitting, breathing air, averaged 31 ± 6%, which is higher than the normally accepted value of 30%. As a result, the upper normal limit for PDS/V_T has been increased to 40% in our laboratories. (Authors' abstract)

1732
Linderholm, H.
LUNG MECHANICS IN SITTING AND HORIZONTAL POSTURES STUDIED BY BODY PLETHYSMOGRAPHIC METHODS. — Amer. Jour. Physiol., 204 (1): 85-91. Jan. 1963.

Mechanical properties of the lungs were examined in normal subjects in the sitting and supine body postures using body plethysmographic and conventional methods. At comparable lung volumes airway conductance or resistance (measured independently of esophageal pressure) was quite uninfluenced, and lung conductance or resistance (determined during high-frequency breathing, when esophageal pressure and intrapleural pressure variations are known to agree better than during ordinary breathing) was almost uninfluenced by changes in body posture. A 'static' lung compliance estimated from plethysmographically measured lung volumes and the corresponding esophageal pressures was less influenced by posture than the conventionally measured 'dynamic' lung compliance. Previously reported differences between lung compliance or resistance in the sitting and supine postures seem to be explained by differences in lung volumes at the measurements and probably also by the variation with posture of differences between intrapleural and esophageal pressure changes during ordinary breathing. Changing from upright to horizontal posture therefore does not seem to alter significantly the true mechanical properties of the lungs. (Author's abstract)

1733
McFarland, J. H.,
H. Werner, and S. Wapner
THE EFFECT OF POSTURAL FACTORS ON THE DISTRIBUTION OF TACTUAL SENSITIVITY AND THE ORGANIZATION OF TACTUAL-KINAESTHETIC SPACE. — Jour. Exper. Psychol., 63 (2): 148-154. Feb. 1962.

Experiments are reported which show the effect of postural tilts left and right on (a) the distribution of tactual sensitivity as measured by the two-point threshold of the palms, and on (b) the organization of tactual-kinaesthetic space as measured by the location of the tactual-kinesthetic straight-ahead. Tilt left increases sensitivity of the right palm compared to the left palm, and also shifts the straight-ahead to the right. Tilt right increases sensitivity of the left palm compared to the right palm, and also shifts the straight-ahead to the left. These findings indicate the necessity of considering postural factors as well as the tactual afferent system in a comprehensive explanation of sensitivity. Further, these findings are viewed as extending the previously found relationship between the distribution of visual sensitivity and the organization of visual space depending on postural factors: that is, for both the visual and the tactual modalities there are systematic directional shifts depending on postural factors. This evidence makes it plausible to postulate an inner relationship between these two types of shifts–distribution of sensitivity and organization of space. (Authors' summary)

1734
Miller, E. F.
COUNTERROLLING OF THE HUMAN EYES PRODUCED BY HEAD TILT WITH RESPECT TO GRAVITY. —Acta oto-laryngologica (Stockholm), 54 (6): 479-501. June 1962. In English.

Also issued as: Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1). Report no. 75, Sept. 1962. ii+32 p.

A photographic method of measuring torsional eye movements (counterrolling) yielded, on the average, a precision of ±5.3 minutes of arc. Using this method, torsional eye movements compensatory to head (body) tilt were found in all planes tested except the sagittal. In the two intermediate (±45°) planes the over-all counterrolling response was quite similar and somewhat less than that found in the case of lateral tilt. Counterrolling always occurred opposite to the lateral component of head tilt and increased fairly rapidly up to a maximum at a head inclination of between 60° and 90°. From this point on counterrolling decreased, but at a lesser rate than it had increased, reaching about zero when the head was positioned vertically downward. A difference in absolute amount of torsion of the right eye found between tilting the head (body) leftward and rightward could not be established. However, no difference in counterrolling could be attributed to the order (clockwise or counterclockwise) in which the measurements were made. Variability in counterrolling response was found to be considerable at every position. A theory attempting to explain the mechanism of otolith organ stimulation is presented. (Author's summary)

1735
Naimark, A.,
and K. Wasserman
THE EFFECT OF POSTURE ON PULMONARY CAPILLARY BLOOD FLOW IN MAN. —Jour. Clinical Investigation, 41 (5): 949-954. May 1962.

The effects of posture and distribution of blood volume on cardiac output, stroke volume, and instantaneous pulmonary capillary blood flow were studied in normal male subjects by a modification of the nitrous oxide technique. The results indicate that the changes in cardiac output and stroke volume that ordinarily accompany changes in posture can be prevented if shifts in blood volume are prevented. The results support the contention that the thoracic blood volume is an important determinant of the stroke output of the heart in normal resting man. Blood flow through the pulmonary capillaries is pulsatile in both the upright and horizontal postures. The amplitude of the pulsations is increased in the horizontal posture. This increase is related to coincident changes in stroke volume and not to the posture itself. (Authors' summary and conclusions)

1736
Pentecost, B. L.,
D. W. Irving, and J. P. Shillingford
THE EFFECTS OF POSTURE ON THE BLOOD FLOW IN THE INFERIOR VENA CAVA.—Clinical Science (London), 24 (1): 149-158. Feb. 1963.

A marked initial fall in the inferior vena cava blood flow was found in subjects assuming the feet-down position, and the magnitude of this reduction correlated directly with the angle of tilt. Subsequent to the initial reduction there was an increase in flow occurring over the next five to eight minutes at the end of which period a steady-flow state was reached. The final blood flow when tilted, compared with horizontal flow, was again dependent upon the angle of tilt. In the head-down position there was an increase in inferior vena cava blood flow. This was possibly due to the emptying of pooled venous blood from the legs but it was maintained for over several minutes indicating that other factors may have been involved. (Authors' summary, modified)

1737
Rao, S.
METABOLIC COST OF HEAD-STAND POSTURE. —Jour. Applied Physiol., 17 (1): 117-118. Jan. 1962.

The cost with the body in the topsy-turvy posture, or while "standing on the head", has not been reported so far. Energy expenditure was calculated indirectly by estimating the amount of oxygen consumed while in a particular posture. A Benedict-type recording spirometer was used for this purpose. The subjects were six healthy medical students. The mean cost of standing on the head was determined to be 336 ml. O_2, or 1.62 kcal./min., and that of "suspension by the feet" to be 300 ml., or 1.44 kcal./min. The possible causes of increased consumption in relation to the "standing erect" posture are discussed. (From the author's abstract)

1738
Strobl, G.,
and P. Follmann
[VARIATIONS OF INTRAOCULAR PRESSURE DURING POSTURAL CHANGES] Intraokulare Druckschwankungen bei Änderung der Körperlage. —Acta chirurgica Academiae scientiarum hungaricae (Budapest), 3 (4): 411-414. 1962. In German, with English summary (p. 414).

Tonometric determinations of the intraocular pressure and readings of blood pressure were made on a group of healthy subjects of the ages ranging from 20 to 40 years. To exclude the tonographic effect, six determinations were made in each body position with 3.5-minute intervals between each. In each position the first measurement was made after a 10-minute rest period. The following sequence of position changes was used: sitting, lying, sitting, lying. The results indicate that the intraocular pressure varies significantly as a consequence of changes in body position. The direction and extent of the change are subject to individual differences; a positive and a negative type can be differentiated.

1739a
Wilson, M. F.
LEFT VENTRICULAR DIAMETER, POSTURE, AND EXERCISE. — Circulation Research, 11 (1, part 1): 90-95. July 1962.

Continuous measurements of a transverse left ventricular diameter have been recorded by an indwelling gauge based upon the mutual-inductance principle. The gauging system is of simple design and construction and may be used with commercially available amplifier and recording equipment. The waveform of this measurement resembles published cardiometer records of combined ventricular volume curves. The direction and magnitude of the variations in left ventricular diameter with changes in posture and with exercise at 3 m.p.h. on a 5% grade are in agreement with those obtained by sonocardiometry. With higher rates of treadmill exercise, the stroke change in diameter is greater than in the recumbent control. (Author's summary)

q. Other Agents

1739b
Boikova, L. T.
[ZINC CONTENT IN TISSUES AND ORGANS OF RABBITS DURING COMPLETE FASTING] Soderzhanie tsinka v tkaniakh i organakh krolikov pri polnom golodanii.—Voprosy pitaniia (Moskva), 22 (3): 47-50. May-June 1963. In Russian, with English summary (p. 50).

Ten starved rabbits perished within approximately 15 days, during which time their weight had reduced by 35 to 47%. The zinc content in the animals' blood rose from the tenth day on and remained elevated as compared to controls. The zinc concentration in the viscera was as follows: in the liver 40%, in the kidneys 64.5%, and in the muscles 31.7% higher than in the controls, while it was reduced by 31.6% in the lungs, by 20% in the heart, by 35.6% in the bones, and by 39.5% in the brain. It is concluded that the accumulation of zinc in the liver, brain, muscles, and kidneys could be regarded as an adaptation reaction to maintain an adequate level of vitamin C.

1740
Chernomordikov, V. V.
AIR HUMIDITY AS AN ECOLOGIC-PHYSIOLOGICAL FACTOR.—U. S. Joint Pub. Research Serv. (Washington), no. 12172 (CSO:6892-N), Jan. 26, 1962. (Avialable from Office of Technical Services, U. S. Dept. Commerce)

English translation of: Vlazhnost' vozdukha kak ekologo-fiziologicheskii faktor.—Doklady Akademii nauk SSSR (Moskva), 140 (4): 935-937. Oct. 1961. In Russian.

The effect of humidity during moderate environmental temperatures was investigated with groups of black rats and Norwegian rats, as well as selected species of birds. Air temperature was maintained between 15 and 21° C. Relative humidity was varied on different days from 40% to 80%. Total caloric value of the food consumed in a 24-hour period was used as an index of the metabolic requirements. In both species of rats the daily food requirement varied inversely with the relative humidity in the room; in Norwegian rats the maximum variance was 13.5%, in the black rats this difference was 60.9% partly due to the younger age level. The food requirement for birds increased at first with the increase in relative humidity, stayed at a plateau, and then increased once more.

1741
Deleanu, C. M.
[INVESTIGATIONS OF THE AIR IONIZATION AS AN ENVIRONMENTAL FACTOR AND ITS EFFECTS ON THE ORGANISM] Untersuchungen über die Luftionisation als Umweltfaktor und ihre Wirkung auf den Organismus.—Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete (Berlin), 8 (10): 776-781. Oct. 1962. In German, with English summary (p. 781).

The results of investigations concerning air ionization are discussed with reference to the atmospheric air in industrial centers, health resorts, and closed rooms. Experiments were carried out with air ionotherapy in cases of anaphylaxis, adrenocortical involvement, gastrointestinal disorders, etc. Some data are given on the nervous and endocrine mechanism of the action of air ions. Predominantly negative ionization produced, in general, the most favorable effects. Some of the results obtained with air ionotherapy in man are reported. (Author's summary, modified)

1742
Ellinger, F. P.
INFLUENCE OF PHOTODYNAMIC SUBSTANCES.—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 350-351. Amsterdam: Elsevier Publishing Company, 1963.

The phenomenon of photosensitization is discussed with respect to causal agents, i.e. the presence of endogenous or exogenous fluorescent substances. Photosensitization should be differentiated from photo-allergy in which the process of photosensitization can be transmitted passively by serum injections.

1743
Holečková, E.
and F. Chytil
NATURAL ADAPTATION TO INTERMITTENT STARVATION IN WILD NORWAY RATS.—Physiologia bohemoslovenica (Praha), 12 (3): 177-182. 1963. In English.

The weight of liver and adrenals was compared in a group of wild rats and domesticated (Wistar) rats.

The wild animals had higher absolute weights of liver and adrenals than domesticated rats; this difference increased with increasing body weight and age. The glycogen content of the liver and the activity of liver tryptophan pyrrolase, as well as the cholesterol content of the adrenals were higher in the wild rats than in the domesticated rats. Adaptation of domestic rats to intermittent starvation in the laboratory resulted in an increase of the liver glycogen content and the cholesterol content in the adrenals as well as to an increase in the activity of liver tryptophan pyrrolase.

1744
Imaichi, K.,
G. D. Michaels, S. Holton, and L. W. Kinsell
PLASMA LIPID FATTY ACIDS DURING FASTING.—Amer. Jour. Clinical Nutrition, 13 (4): 226-231. Oct. 1963.

It does not appear that the composition of plasma free fatty acids and triglycerides during fasting is a simple resultant of mobilization from adipose tissue and utilization of all fatty acids at equal rates by peripheral tissues. Changes in the concentration of polyunsaturated fatty acids in the cholesterol ester and total phospholipid fractions suggest increased synthesis and/or decreased utilization of fatty acids. (Authors' summary and conclusions, modified)

1745
Korchak, H. M.,
and E. J. Masoro
CHANGES IN THE LEVEL OF THE FATTY ACID SYNTHESIZING ENZYMES DURING STARVATION. — Tufts Univ. School of Medicine, Boston, Mass. (Contract AF 41(657)321); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-02). Technical Documentary Report no. AAL-TDR-61-46, May 1962. iii+5 p.

The activity of acetyl CoA carboxylase is depressed significantly in 24 hours of fasting and markedly by 72 hours of fasting, while the activity of fatty acid synthetase is not significantly depressed in 24 hours of fasting but is depressed at the end of a 72 hour fast. Evidence is presented that indicates changes in the enzyme levels during fasting do not cause the depressed lipogenesis of this condition but are more likely the result of the low rate of lipogenesis initiated by other factors such as the disappearance of lipogenesis stimulators and the appearance of lipogenic inhibitors. (Authors' abstract)

1746
Krueger, A. P.,
S. Kotaka, and P. C. Andriese
SOME OBSERVATIONS ON THE PHYSIOLOGICAL EFFECTS OF GASEOUS IONS.—International Jour. Biometeorology (Bern), 6 (1): 33-48. Nov. 1962.

Some of the evidence pertaining to the biological effects of gaseous ions is reviewed. Data now available suggest that reproducible biological effects occur in a variety of living forms including microorganisms, higher plants, insects, animals, and man. The responses generally are limited in extent and to indict air ions as their sole cause requires great care in defining the experimental conditions. Some progress has been made in detecting the fundamental biochemical reactions associated with ion-induced physiological changes. The ready availability of excellent apparatus for generation and measurement of air ions, coupled with present-day knowledge about their properties, makes critical experimentation possible. (Authors' abstract) (38 references)

1747
Krueger, P.,
W. W. Hicks, and J. C. Beckett
INFLUENCE OF AIR IONS ON CERTAIN PHYSIOLOGICAL FUNCTIONS.—In: S[olco] W[alle] Tromp, Medical biometeorology: weather, climate and the living organism, p. 351-369. Amsterdam: Elsevier Publishing Company, 1963.

The biological effects of positively and negatively charged air ions are reviewed. Lethal effects of both positive and negative air ions have been shown experimentally with cultures of *Neurospora crassa*. High densities of positive air ions produce symptoms of dryness, burning, and itching of the nose, nasal obstruction, headache, dry scratchy throat, dizziness, difficulty in breathing, itching of eyes, and a lowered maximum breathing capacity probably due to swelling of the nasal mucosa. In vitro experiments with tracheal strips showed that positive ions contracted the tracheal wall, dried the mucosa, and made the cilia vulnerable to mechanical trauma. Negative ions raised the rate of ciliary beat, without any clear-cut effect on the flow of the mucus. Their action may be via one or more of the intracellular respiratory enzymes, e.g., cytochrome oxidase. It has been possible to establish the upper and lower limits for air ion effects. Recently, chronic exposure of human subjects to positive ions has resulted in a rise of blood pressure, a decrease in blood albumin, an increase in the globulin fraction of blood, a drop in the cholesterol level, and a rise in 17-ketosteroids. Negative ions raised the blood albumin and lowered the globulin. Air-ion control may be a vital factor for optimum environmental conditions in closed systems. (51 references)

1748
Miettinen, M.
EFFECT OF FASTING ON SERUM LIPOPROTEINS. — Annales medicinae internae Fenniae (Helsinki), 51 (3): 169-172. 1962. In English.

In 12 healthy men fasting for two days the total serum cholesterol and its distribution in alpha and beta lipoprotein fractions were determined before and after the first and second days of fast. The total serum cholesterol increased significantly during the first fasting day (from 259 to 281 mg./100 cc.) and even further during the second day (to 296 mg./100 cc.). The corresponding amounts in the beta fraction were 208, 224, and 239 mg./100 cc., and in the alpha fraction 51, 57, and 57 mg./100 cc., respectively. (From the author's summary)

1749
Minkh, A. A.
[HIGHLY IONIZED ATMOSPHERE AS A FACTOR INCREASING PHYSICAL WORK CAPACITY]
Vysokoionizirovannyi vozdukh kak faktor povysheniia fizicheskoi rabotosposobnosti.—Vestnik Akademii meditsinskikh nauk (Moskva), 18 (2): 33-38. 1963. In Russian.

Male subjects were exposed to negatively ionized air for 15 minutes daily for 25 days, receiving a dose of approximately 200 billion ions during each exposure. In general, all subjects reported a significant improvement in the state of health, appetite, and sleep. No significant effects were noted on blood pressure and pulse and respiration rates. During the first nine days there was no significant change in the physical performance capacity; however, thereafter the capacity for static work increased 46%, for dynamic work 59.5%, and was further augmented by 87% by the 25th day; motor reaction time was continually shortened during the exposure and was reduced by 22 milliseconds at the end of the experiment. The urine constituents were as follows: vitamin B_1 excretion rose from 6.2 to 10.8 γ/hour, pyrotartaric acid excretion fell from 6.7 to 3.9 γ/hour, while the excretion of vitamin B_2, N'-methylnicotineamide, and vitamin C rose from 11.9 to 23.7 γ/hour, from 0.49 to 0.73 γ/hour, and from 0.53 to 0.63 γ/hour, respectively. Women exposed to similar conditions also showed an increased work capacity, but changes in their urine indices were more pronounced. A test group exposed to ionized water vapor showed a certain improvement in the physical work capacity, but to a lesser extent than the groups exposed to ionized air. It is concluded that negatively ionized air enhances the metabolism of water-soluble vitamins.

1750
Mueller, P. S.,
and W. H. Evans
RESPONSES OF PLASMA GLYCEROL CONCENTRATIONS TO EPINEPHRINE, NOREPINEPHRINE, GLUCOSE, INSULIN, AND PROLONGED FASTING IN MAN.—Jour. Lab. and Clinical Med., 61 (6): 953-961. June 1963.

Plasma glycerol and free fatty acid (FFA) concentrations were measured in volunteers before, after, and during a 24 hour fast. The mean concentration of glycerol after an overnight fast was approximately 0.082 micromoles per milliliter. There was no correlation between glycerol and FAA concentrations at this time. After 24 hours of fasting there was a significant rise in plasma glycerol, but this elevation occurred six hours later than the increase in FFA. There was no correlation between FFA and glycerol concentrations at any period of the fast. (Authors' summary, modified)

1751
Pipal, M.,
V. Dolezhal, I. Dvorzhak, M. Moravek, O. Prokhazka, I. Shtverak, and I. Tuma
[THE EFFECT OF BRIEF FASTING ON MAN]
Vliianie kratkovremennogo golodaniia na organizm cheloveka.—Voprosy pitaniia (Moskva), 22 (2): 35-39. March-April 1963. In Russian, with English summary (p. 39).

Five subjects were kept without food for 5 days, but without restrictions in water consumption. No changes of basal metabolism were observed during the 5-day period. The average daily water intake was 1300 ml., the urine volume 1000 ml. The total nitrogen content of the urine was lowered during the first two days, reached a maximum on the third day, and fell below controls on the fifth day. The protein nitrogen in the blood serum reached a maximum on the third day, while the level of iron protein nitrogen remained unchanged. During the whole period, there was a steady increase of sugar and vitamin C content in the urine. Decreased tolerance to hyperventilation and increased tolerance to hypoxia were also noted. There was a slight reduction in visual accommodation and a slight improvement in night vision and in depth perception.

1752
Prasannan, K. G.,
R. Rajan, and K. Subrahmanyam
BRAIN GLYCOGEN IN THE FED AND FASTING STATE.—Indian Jour. Med. Research (New Delhi), 51 (4): 703-707. July 1963.

Whole-brain glycogen levels of adult male albino rats in both fed and fasted groups were studied. An adaptation of the method of McIlwain and Tresize was used to make the glycogen level estimations. This method is described in detail. Liver glycogen levels of the same rats were estimated for comparison. Brain glycogen is significantly depressed (28%) as a result of fasting for 24 hours. This is much less than the fall in the amount of glycogen in the liver which is 82%. The dissimilarity of these results with those of earlier studies is discussed.

1753
Shapiro, IU. L.
[CHANGES IN THE LEUCOCYTIC COMPOSITION OF HUMAN BLOOD DURING PROLONGED TOTAL STARVATION AND SUBSEQUENT FEEDING]
Izmenenie leikotsitarnogo sostava krovi pri polnom dlitel'nom alimentarnom golodanii i posleduiushchem pitanii u liudei.—Patologicheskaia fiziologiia i eksperimental'naia terapiia (Moskva), 7 (1): 39-44. Jan.-Feb. 1963. In Russian, with English summary (p. 43-44).

Nineteen mental patients and two normal controls were exposed to total starvation (with unlimited water intake for periods up to 40 days. In all subjects leukopenia set in approximately 14 days after the beginning of the experiment. Polymorphonuclear neutrophils and lymphocytes were reduced in number; the neutrophils showed degenerative morphological changes, while their differentiation in the bone marrow appeared to be normal. Eosinophil and lymphocyte counts were less than normal during the first four days of fasting, increased during the 5th to 12th days, and again decreased afterwards. Restitution in blood morphology began 1 1/2 to 2 1/2 weeks after resumption of a normal feeding routine, and was completed 3 1/2 months after the termination of fasting.

1754
Tamarin, A.,
and L. M. Sreebny
EFFECTS OF TOTAL INANITION ON THE SUBMAXILLARY GLAND OF THE RAT.—Arch. Oral Biology (London), 7: 469-480. July-Aug. 1962.

Fifty-four rats were divided into nine groups of six animals each and starved for periods of 0, 3, 12, 24, 48, 72, 120, 168, and 216 hours. During starvation, the maxillary gland lost weight in proportion to the loss of body weight. This weight loss was mainly due to shrinkage in the size of tubular and acinar cells, and progressed with the increasing

duration of starvation. The diameter of the convoluted tubules likewise decreased with the duration of starvation and was related to the decreased size of the tubular cells. The lines of regression for the increase in tubular and acinar cell density plotted as a function of the periods of starvation had the same slopes indicating that both cell types decreased in size at the same rate. Acinar cells demonstrated more profound pathological changes than did tubular cells for equal periods of inanition. The nuclei of tubular cells were more elongated than those of acinar cells and starvation seemed to have no effect on the shape and size of the nuclei. (Authors' abstract, modified)

7. PERSONNEL

[General psychological aspects under 5]

1755
Demaree, R. G.,
and M. R. Marks
DEVELOPMENT OF QUALITATIVE AND QUANTITATIVE PERSONNEL REQUIREMENTS INFORMATION.—Matrix Corp., Arlington, Va. (Contract AF 33(616)-7464); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171005). Technical Documentary Report no. MRL-TDR-62-4, Dec. 1962. v+82 p.

This report describes the nature of, purpose and method for developing Qualitative and Quantitative Personnel Requirements Information (QQPRI). The report is intended to aid Air Force and contractor personnel in the development and use of QQPRI. The first section of the report covers the nature and scope of QQPRI and relationship of QQPRI to system development. The second section describes the general constraints within which QQPRI is developed. Such constraints include technical weapon system constraints as well as policies on Air Force Personnel, Training, and Manning. The third and largest section covers QQPRI development techniques such as task analyses, estimation of performance time, establishing Air Force positions and determining the relation of these to existing Air Force specialities. The fourth section covers the QQPRI Report, its preparation and uses. (Authors' abstract)

1756
(Federal Aviation Agency)
LIST OF AVIATION MEDICAL EXAMINERS. — Federal Aviation Agency, Aviation Medical Service, Washington, D. C. 234 p. July 1962.

The physicians authorized to conduct physical examinations of airmen for the Administrator of the Federal Aviation Agency (FAA) are listed. The arrangement is as follows: Part I, Alphabetical listing of examiners by name, city, and state; Part II, Alphabetical listing of examiners by state and city; and Part III, Listing of military installations where FAA physical examinations may be performed. The names of approved examiners in 58 foreign countries are also given.

1757
Freeman, R. H.
PARACHUTE MEDICAL SERVICES.—Midland Med. Rev. (Birmingham, England), 1 (4): 354-358. Spring 1962.

The organization and activities of the 23rd Parachute Field Ambulance of the British Air Force Parachute Medical Services are discussed. Volunteers are selected from civil life or other service units after a rigorous test associated with physical fitness, agility, confidence, intelligence, leadership, and endurance. Once a candidate has successfully passed this course, he spends a month undergoing ground training and gaining air experience. Parachute medical services include a surgical team, casualty collecting sections, mountain rescue team, surgical and dental teams, transport section, etc. Along with normal training, members of this service undergo training in winter warfare and survival in both hot and cold environments.

1758
Tomlinson, H.,
and J. A. Elson
ABSTRACTS OF PERSONNEL RESEARCH REPORTS. I. 1954-1957. —— Aerospace Medical Division. Personnel Research Lab. (6570th), Lackland Air Force Base, Tex. (Projects no. 7717 and 7719). Technical Documentary Report no. PRL-TDR-62-25, Dec. 1962. v+42 p.

Abstracts are assembled of 145 technical documentary reports issued by the Air Force's Personnel Research Laboratory from January 1954 through December 1957. They cover research projects in selection, classification, and utilization of Air Force personnel. The reports are indexed by personal author, corporate author, and ARDC project number. (Authors' abstract)

1759
Tomlinson, H.,
and J. A. Elson
ABSTRACTS OF PERSONNEL RESEARCH REPORTS. II. 1958-1961. —— Aerospace Medical Division. Personnel Research Lab. (6570th), Lackland Air Force Base, Tex. (Projects no. 7717, 7719, and 7734). Technical Documentary Report no. PRL-TDR-62-26, Dec. 1962. v+33 p.

Abstracts are assembled of 126 technical documentary reports issued by the Air Force's Personnel Research Laboratory from January 1958 through December 1961. They cover research projects in selection, classification, and utilization of Air Force personnel. The reports are indexed by personal author, corporate author, and project number. (Authors' abstract)

b. Selection, Classification, and Rating

[*Physical examination under 8-f*]

1760
Atroshkin, N. T.
METHOD OF SELECTING RADAR STATION OPERATORS BY SENSORIMOTOR REACTIONS.—Military Medical Journal, 1961 (11): 106-111. Washington: U.S. Joint Pub. Research Serv., no. 12766, March 2, 1962. (Available from Office of Technical Services, U.S. Dept. Commerce)

English translation of: K metodike otbora operatorov radiolokatsionnykh stantsii po sensomotornym reaktsiiam.—Vonno-meditsinskii zhurnal (Moskva), 1961 (11): 66-69. Nov. 1961. In Russian.

Sensorimotor reactions of 240 radar-station operators were examined by means of the NIIIAM apparatus (complex visual display apparatus developed by the Scientific Research Testing Institute of Aviation Medicine) and the results compared with their work-performance ratings. Three sensorimotor tests were included: (1) simple reaction time to a light signal, (2) visual motor reaction to a complex of stimuli combined with the appearance of a sudden extraneous stimulus (bell sound), and (3) visual motor switching reaction, where the interrelationship of keys changed upon a certain signal. The results of laboratory examination were in agreement with performance ratings in 59% of cases. However, these tests showed some promise as predictors of performance under stress, e.g., under combat conditions.

1761
Berry, C. A.
HUMAN QUALIFICATIONS, SELECTION AND TRAINING FOR SPACEFLIGHT.— Med. Jour. Australia (Sydney), 1963 (12): 421-425. March 23, 1963.

To qualify as an astronaut a candidate must be an experienced jet pilot, have earned at least a bachelor's degree in the physical or biological sciences or in engineering, be a United States citizen, and under 35 years of age at the time of selection. The screening examination consists of a detailed medical history and system review, comprehensive physical examination, electroencephalographic examination, diagnostic hearing tests and labyrinth function tests, pulmonary and cardiovascular function tests, phonocardiography, plethysmography, electrocardiography and vector cardiography, exercise tolerance tests, tilt-table studies, cold pressor and Valsalva tests, radiographic examination (lungs, stomach, genitourinary tract, spine, and sinuses), and laboratory examinations (blood, urine, feces). Various psychophysiological stress tests are also given. Indoctrination and training is aimed at exposing the candidate to every stress to be encountered in space flight such as accelerations, high altitudes, heat changes, working with spacecraft simulator and rescue equipment, testing drug reactions, and isolation tests.

1762
Brisson, de
[CONCERNING GRAPHOLOGY AND THE SELECTION OF PILOTS] À propos de graphologie et de sélection des pilotes.—Forces aériennes françaises (Paris), 17 (193): 897-900. June 1963. In French.

The invalidity of graphology as a psychotechnique used in the selection of pilots is discussed, in contrast to the favorable results previously published by A. Gaussin ("Graphologic contribution to the selection of military pilots," in Forces aériennes françaises, April 1963). Graphology is not considered an adequate means for the evaluation of personality, and constitutes insecure data on which to base a candidate's aptitude for flying.

1763
Cassie, A.
CONSTANCY AND CHANGE IN PILOT APTITUDE. —In: Defence Psychology: Proceedings of a symposium held in Paris, 1960 (NATO Conference Series, 1), p. 91-96; discussion, p. 96-98. Ed. by Frank A. Geldard. Oxford, etc.: Pergamon Press, 1962.

The original pilot aptitude tests developed in the United States during World War II have since been adopted and incorporated almost unchanged into various aircrew selection test batteries throughout the Western world. Geographical variations in the choice of selection tests have been imposed by administrative difficulties in different countries, a shift of recruitment to a different population sample, and the special needs of each selecting agency. Repeated validation studies have exposed extensive fluctuations in the validity of aircrew selection tests which reflect the shift to a different applicant and trainee population, and the changes in the pilot training curriculum; e.g., a shift toward the use of jet aircraft for training has relieved the stress on rapid acquisition of complex coordination. Other skills have gained importance, i.e., the ability for multi-channel mental tracking coupled with a rapid detection of cues for action. The author suggests that in view of the changing nature of the pilot's function which has now become increasingly that of a monitor, the pilot aptitude testing will have to be remodeled in accordance with the above concept.

1764
Castagliuolo, P.,
and C. Koch
[VESTIBULAR FUNCTION AND BEHAVIOR OF THE PILOT TRAINEE IN FLIGHT] La funzione vestibolare ed il comportamento in vole dell 'allievo pilota.— Rivista di medicina aeronautica e spaziale (Roma), 26 (3): 454-463. July-Sept. 1963. In Italian, with English summary (p. 461-462).

Of a total of 940 pilot candidates 277 were selected as physically fit and 89 were admitted to pilot training. Results of vestibular function tests (electronystagmography) were compared with the behavior of each trainee during the first period of flight training (25 flights). Of the 89 candidates 29 (32.5%) were eliminated during training for various reasons. In general there was a fairly good correlation between the flying ability and a normal electronystagmogram.

1765
Cobb, B. B.
PROBLEMS IN AIR TRAFFIC MANAGEMENT. II. PREDICTION OF SUCCESS IN AIR TRAFFIC CONTROLLER SCHOOL. —— Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Oklahoma. Report no. 62-2, Feb. 1962. 15 p.

An analysis of scores for an extensive battery of psychological tests administered to a large number of air traffic controller (ATC) trainees indicated that such tests can make a useful contribution in the selection of personnel for ATC training. Five test areas which emerged as most predictive of ATC school performance were: abstract reasoning, numerical ability, spatial relations, non-verbal analogies, and a specially designed test of air traffic control problems. (Author's abstract)

1766
Dailey, J. T.,
M. F. Shaycoft, and D. B. Orr
CALIBRATION OF AIR FORCE SELECTION TESTS TO PROJECT TALENT NORMS. —— American Inst.

for Research, Washington, D. C. (Contract AF 41(657)-324); issued by Aerospace Medical Division. Personnel Research Lab. (6570th), Lackland Air Force Base, Tex. (Project no. 7717, Task no. 771705). Technical Documentary Report no. PRL-TDR-62-6, May 1962. iv+20 p.

To tie in norms for Air Force personnel tests with the full range of talent in the recruitment population, the Project TALENT test battery was given to a sample of basic airmen. The sample was split into halves, each numbering over 1200 airmen. By multiple regression techniques, applied separately to each half sample, composites of TALENT tests were selected to predict scores on each of 27 Air Force tests. Close agreement between the two samples on tests selected and regression weights derived gives confidence in the results. Tables were prepared of equivalent scores between each Air Force test and the best composite of TALENT tests. (Authors' abstract)

1767
Denis, R.
[CHARACTEROLOGY IN THE SERVICE OF AVIATION?] La caractérologie au service de l'aviation?—Forces aériennes françaises (Paris), 17 (192): 705-718. May 1963. In French.

Psychotechnical tests are of great value in the selection of aviation candidates. Sensory, sensory-motor, and psychomotor aptitudes are measured by three psychotechnical methods: questionnaire, physiognomic examination, and graphologic analysis. The results from these methods are inscribed on a characterogram, a form composed of nine concentric circles bearing the vectors of bi-polar personality traits. Thus a clear picture of the candidates total personality and the interaction of personality traits are obtained on three levels: constitutional (morphology), social (questionnaire), and mental (graphology). Each method is represented by an adequate description on the characterogram: vegetative-motor, emotive-affective, and reflexive-ideative. Following a profile analysis, a graphic representation of the personality may be made.

1768
de Wet, D. R.
THE ROUNDABOUT: A ROTARY PURSUIT-TEST, AND ITS INVESTIGATION ON PROSPECTIVE AIR-PILOTS.—Psychologica africana (Johannesburg), 10 (1): 48-62. Jan. 1963.

The construction and experimental application of a sensorimotor test is described. This test involves postural balance, co-ordinated response from diverse body-musculature, distribution of attention, and flexibility in reacting to a sudden change of "set", all of which may be applied at three levels of difficulty. The Roundabout Test comprises the two-fold task of balancing a ball on a mortar-board while moving about to keep a pointer synchronized with the mark on a rotating disk. Validity study of the test on forty-seven pilot candidates selected from a group of 161 applicants indicated that at least one aspect of this test—the "Error Time"—has some validity for prediction of success or failure in flight training.

1769
Dimitrov, D.,
and D. Ionchev
[ON THE PROBLEM OF THE PSYCHOPHYSIOLOGICAL SELECTION OF PILOT CANDIDATES] Po vuprosa za psikhofiziologicheskiia podbor na kandidatite za lettsi. — Voenno meditsinsko delo (Sofiia), 17 (2): 63-71. June 1962. In Bulgarian, with Russian summary (p. 76).

An analysis is presented of individual psychological tests carried out on 1040 pilot candidates to evaluate their probable success in flight. Approximately 65% of the favorable predictions were correct, with most of them falling in the average range. These results are regarded as encouraging.

1770
Doll, R. E.
PEER RATING VALIDITY AS A FUNCTION OF RATER INTELLIGENCE AND RATING SCORE RECEIVED.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-5001, Subtask 1). Report no. 24, March 15, 1963. ii+5 p.

Peer Rating used in the Naval Air Training Program have proved quite useful in predicting subsequent failures. This study attempts to determine the relationship of two rater "characteristics", intelligence and Peer Rating score received, to the validity of the ratings given. Results from three analytic approaches to the records of 548 cadets demonstrate that when dealing with a population having generally above average intelligence there is little reason to take into consideration rater intelligence when concerned with the validity of the ratings he gives. This is also true for the Peer Rating score received by the rater. (Author's summary)

1771
Erdbrink, W. L.
VISION IN MILITARY OCCUPATION PLACEMENT. — Arch. Environmental Health, 4 (5): 528-537. May 1962.

A scheme is presented for the development of a physical profile–occupational classification to correlate visual capacity with the duties performed in order to promote efficiency, prevent accidents, improve morale, and utilize manpower maximally. By the establishment of a classification board at all military boot camps and training schools, new trainees may be selectively placed in a suitable rate or military occupation specialty. This board, acting on the findings of a complete and accurate physical examination, would also help to eliminate those not physically qualified. A group of cases discharged from the service with conditions-existing-prior-to-enlistment is presented. The establishment of a classification board at all major military hospitals would assist in the reclassification and rehabilitation of personnel who are partially handicapped following disease or injury. Those with long-standing or recently developed unilateral blindness or with unilateral enucleation would be fully evaluated individually prior to a decision concerning duty status. Several groups of cases of one-eyed personnel are presented, illustrating the magnitude of the problems. (Author's summary, modified)

1772
Evrard, E.
[EVALUATION OF THE PALMAR PERSPIRATION TEST IN THE SELECTION OF AVIATORS] Expérimentation du test de perspiration palmaire dans la sélection des aviateurs.—Revue de médecine aéronautique (Paris), 1 (3): 39-41. March-April 1962. In French.

The palmar perspiration test of McCleary (1953) given to 529 pilot candidates in a decompression chamber revealed two groups with abnormally high perspiration levels, i.e., 0.3 gram and higher: (1) individuals presenting otalgias due to barotrauma, and (2) individuals presenting anxiety traits. A stress of physiological origin (barotrauma), or psychic origin (strange environment considered dangerous by the anxious subject) was present in 34 out of the 39 abnormal cases, or 87% of the cases. Results from subjects with normal perspiration levels did not permit easy or practical conclusions. The test is not considered of value as a positive selection test of aviators if the results are based on flight apprenticeship. If, on the contrary, during initial examination, a psychiatric test is given to eliminate candidates, it may be of actual value. The test provides quantitative data for the detection of anxiety-prone individuals. Considered in this manner, it may perhaps be useful for the selection of aviators.

1773
Evrard, E.
[USE OF THE BOURDON-WIERSMA TEST IN THE SELECTION OF AVIATORS] L'emploi du test de Bourdon-Wiersma dans la sélection des aviateurs.—Revue de médecine aéronautique (Paris), 1 (3): 42-44. March-April 1962. In French.

The results are evaluated of the Bourdon-Wiersma test (stipple test) given to 651 pilot students in relation to their significance in the selection of aviators. The test is not considered a replacement for other tests, nor a substitute for the precise methods and objectives of electroencephalography, but as a means of screening existing abnormalities having an organic nervous or psychic basis. It may successfully be incorporated into a test battery. It contributes to the detection of epileptics and hysterics, and demonstrates fluctuations in the level of consciousness.

1774
Gorbov, F. D.
[SOME PROBLEMS OF SPACE PSYCHOLOGY] Nekotorye voprosy kosmicheskoi psikhologii.—Voprosy psikhologii (Moskva), 8 (6): 3-13. Nov.-Dec. 1962. In Russian, with English summary (p. 13).

There is a similarity in the functional requirements for cosmonauts and pilots. The psychological approach to the selection of space personnel should consider certain factors which are of principal importance: the response and performance of personnel exposed to stresses of continuous and compulsory types of activity and their reactions to perceptual stimuli, to unexpected factors, and to "postural" factors, should be used in the fitness evaluation. Laboratory experiments conducted within these types of response under simulated conditions may be applied towards the development of reliable diagnostic and selection methods for space personnel.

1775
Hoogerheide, J.
CONSIDERATIONS ABOUT THE ACCEPTABILITY OF MILD COLOUR DEFECTIVE TRICHROMATES IN FLYING PERSONNEL.—Aeromedica acta (Soesterberg, The Netherlands), 8: 17-23. 1961-1962. In English.

An argument is presented for the admission of pilot candidates with a mild degree of color blindness (protanomaly and deuteranomaly) to the flight personnel of the Royal Netherlands Air Force. Such an amendment to the medical requirement would be advantageous because (a) it affords a better appreciation of the over-all flight suitability of the candidate, and (b) it raises the number of acceptable pilot candidates by approximately 3%. In practice the use of colored signal lights has decreased in the civil and in military aviation. Take-off and landing instructions are frequently given by radio and white runway lighting. Also, the importance of ambercolored taxiway lighting, red and green navigation lights, colored lights and color codes on the instrument panels is not as great now as it used to be for the landing procedures and is expected to decline even more so in the future. A proposal has been made to have candidates with a deviation in color vision on the Ishihara test to be examined with pictures of Hardy, Rand, and Rittler, and the simultaneous test lantern of Walraven and Leebeck to determine their actual level of color discrimination.

1776
Klein, K. E.,
H. Brüner, and D. Jovy
MEASURING THE INDIVIDUAL STRESS-SENSITIVITY BY MEANS OF OXYGEN-WANT.—In: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 5-15. Oct. 1963. In English and German.

Hypoxia, as a non-specific stress, resulted in increased corticoids of the adrenal gland and, secondarily, in decreased eosinophils when pilot candidates were tested in a low-pressure chamber at 286.8 Torr total pressure equal to 7500 m. altitude. On the basis of the changes observed, the subjects were classified as types A and B. Type B persons clearly showed more tolerance to hypoxia, and less alteration in corticoids. The differences between A and B types were also clear after heat and cold stress, type B persons being less susceptible. The sum of physical and psychical irritations of flying performance are also systemic, unspecific stresses. Hence a type B person with lower stress sensitivity performs better as a pilot. Selection of type B pilots can be accomplished by means of the hypoxia test.

1777
Lombardo, N.
[SELECTION OF FLYING PERSONNEL IN THE ROYAL AIR FORCE] La selezione del personale navigante nella "Royal Air Force".—Rivista aeronautica (Roma), 39 (5): 709-733. May 1963. In Italian.

A review is presented of the methods used by the British Royal Air Force for the selection of flying personnel, also considering organization and operation of the selection system, its social and economic aspects, methodology and validity. The Aircrew Selection Centre at Hornchurch is divided into three sections: Aptitude Testing Section, Exercise Section, and Medical Section. The Aptitude Testing Section utilizes standard tests for evaluating sensory-motor coordination (performance tests), and intelligence. Performance tests are of eye-hand and eye-hand-foot coordination, and acoustic perception. Intelligence tests examine the subject's educational attainments, aptitudes in general science and mathematics, mechanical comprehension, and general observations. The candidate's psycho-physiological profile is determined by discussions, attitude and planning exercises, leaderless group tasks, individual talks, chairmanship studies, and individual and command situations. Following the exercises the candidates are interviewed and classified according to suitability for flight training. A medical examination is also given to each candidate. Application of the British selection methods to the Italian Air Force is discussed.

1778
Lomonaco, T.
[BASIC CONCEPTS OF A PSYCHO-PHYSICAL SELECTION OF THE COSMONAUT] Lineamenti di una selezione psico-fisica del cosmonauta. — Rivista di medicina aeronautica e spaziale (Roma), 25 (2): 195-218. April-June 1962. In Italian, with English summary (p. 213-214).

The essential requirements for astronauts are investigated along three main lines, namely, physiological, psychological, and aptitudinal requirements. The first class is based on the absence of disease or somatic lesions as well as on thorough functional evaluation of body organs and systems. Tests are made of the tolerance to barometric and explosive decompression, accelerations, pressurization, noises, and vibrations; of the resistance to high carbon dioxide inhalation; and of the behavior at weightlessness. High standards of intelligence, character, and motivation are required which will permit the astronaut to withstand the conditions created by the unusual space-flight situation. Aptitude requirements are the same as those prescribed for flying personnel of modern aircraft, although developed to a higher degree.

1779
Miller, C. P.
BREAKING THE MEDICAL BARRIER. — AOPA Pilot, 5 (2): 23-24, 64-65. Feb. 1962.

Fifteen pilots previously disqualified because of histories of heart trouble were restored to active flying status by the Federal Aviation Agency's Medical Advisory Panel. These pilots were banned by medical standards adopted in 1959 which required the automatic denial of medical certificates to applicants with an established history or clinical diagnosis of myocardial infarctions and certain other coronary heart diseases. Mental disorders, diabetes mellitus requiring insulin or hypoglycemic drugs for control, and chronic alcoholism are also included in the standards. Medical research may eventually enable the relaxation of these rules.

1780
Sells, S. B.
MILITARY SMALL GROUP PERFORMANCE UNDER ISOLATION AND STRESS: CRITICAL REVIEW. IV. SELECTION, INDOCTRINATION, AND TRAINING FOR ARCTIC REMOTE DUTY. — Texas Christian Univ., Fort Worth (Contract AF 41(657)-323); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8243-11). Technical Documentary Report no. AAL-TDR-62-34, June 1962. iv+26 p.

A review of the literature on selection, indoctrination, and training for Arctic remote duty indicates: (a) that marginal airmen can be rather easily identified, although at the cost of a high false-positive rate and that such airmen could be tagged for exclusion from highly demanding, high-risk assignments, provided that other jobs could be found for them elsewhere in the Air Force; (b) that an experimental site briefing, now in use for indoctrination of airmen assigned to Alaskan sites, merits continuation, with care to maintain quality of presentation; and (c) that a number of individual and group training opportunities are worthy of exploitation. These findings are in accord with theoretical predictions. (From the author's abstract) (28 references)

1781
Steininger, K.
[ACTUAL PROBLEMS OF AVIATION PSYCHOLOGY] Aktuelle luftfahrtpsychologische Probleme.— Zeitschrift für experimentelle und angewandte Psychologie (Göttingen), 9 (1): 104-139. 1962. In German, with English summary (p. 137-138).

The purpose of this paper is to present an introduction to the most important problems faced by aviation psychology in the selection of flying personnel on the basis of aptitude, and to discuss special questions and approaches involved in research. The state of art of diagnostic research in Germany is reviewed. In view of the constantly increasing demands of piloting an aircraft, changed conditions of visual flight are described, and the terminological and diagnostic difficulties with respect to the perception of spatial relationships in instrument flight are discussed. The possibilities and limits of human adjustment to the technical developments in aviation are described, considering problems of automation, supersonic flight, perception, and optimal information. The last section is concerned with the problems of mental and emotional adjustment to particular physical conditions, e.g., acceleration, anoxia, drop in atmospheric pressure, climatic changes, etc. (From the author's summary)

1782
Trites, D. K.,
and B. B. Cobb
PROBLEMS IN AIR TRAFFIC MANAGEMENT. III. IMPLICATIONS OF AGE FOR TRAINING AND JOB PERFORMANCE OF AIR TRAFFIC CONTROLLERS. — Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Oklahoma. Report no. 62-3, Feb. 1962. [12] p.

The relationships between chronological age upon entry into air traffic control (ATC) training and school and job performance were examined in five samples of air traffic controller trainees. The data confirm conclusively the existence of an inverse relationship such that the older trainees have significantly less chance than their younger classmates of either completing training or being considered a satisfactory controller. Based upon the results of this investigation it is recommended that a maximum age limit be established for entry into ATC training. (Authors' abstract)

1783
Want, R. L.
THE VALIDITY OF TESTS IN THE SELECTION OF AIR FORCE PILOTS. —— Australian Jour. Psychol. (Melbourne), 14 (2): 133-139. Aug. 1962.

A study was made of the validity of tests selected for the pilot aptitude test battery (Dial Reading, Instrument Comprehension, Silhouettes, General Information, Complex Coordinates, Verbal Intelligence Test, General Mathematics, and General Science). In the first part of the study the stanine scores assigned after arbitrary weighting of tests of all trainees were compared with the scores of those who completed the training successfully (Criterion I). In a second part of the study the results of trainees suspended for reasons other than failure to learn to fly were excluded from the scores of the general group of trainees which were then compared to the successful group (Criterion II). The multiple correlations obtained indicate that the tests have been well calibrated against the pure flying criterion, i.e., .68 with Criterion II and .63 with Criterion I.

1784
Willingham, W. W.,
and R. K. Ambler
COMPARISON OF METHODS FOR DERIVING PEER NOMINATION SCORES.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3003, Subtask 1). Report no. 35, May 29, 1962. ii+5 p.

The purpose of this study was to determine by empirical means the optimal method for scaling peer nomination scores for groups of unequal size. Within-section peer nominations for the traits of Cautiousness, Original Thinking, Personal Relations, and Vigor were obtained for 208 naval aviation cadets divided into 11 sections of unequal size. These nominations were scaled by six methods. These distributions then were correlated with the Gordon Personal Inventory scales for the same traits. It was concluded that the type of score typically used is inferior. Relatively simple modifications will result in more precise measurement. (Authors' abstract)

c. Training

[Flight simulators under 11-d]

1785
Adams, J. A.,
and L. E. Hufford
CONTRIBUTIONS OF A PART-TASK TRAINER TO THE LEARNING AND RELEARNING OF A TIME-SHARED FLIGHT MANEUVER. —— Human Factors, 4 (3): 159-170. June 1962.

A cockpit procedures trainer is a part-task simulator that has no aerodynamic simulation, and it is used to teach in-flight procedural responses without provision for practicing the flight controlling responses that are often time-shared with them in the aircraft. Using a flight simulator as the research device, two experiments were performed to test the importance of time-sharing in original learning and retention. In Experiment I an experimental group originally learned procedures and flight controlling separately without an opportunity to learn their time-sharing, whereas a control group practiced the integrated whole task. Experiment II sought the importance of time-sharing in retention over 10 months. An experimental group used a cockpit procedures trainer to reinstate forgotten aircraft procedures, while a control group relearned in the whole task. Both experiments confirmed the time-sharing hypothesis. The cockpit procedures trainer contributed importantly to original learning and relearning, but the presence of time-sharing required additional whole-task practice to optimize performance. (Authors' summary)

1786
Berger, R. A.
COMPARISON OF STATIC AND DYNAMIC STRENGTH INCREASES. —— Research Quarterly, 33 (3): 329-333. Oct. 1962.

Tests for static and dynamic strength of the lower back muscles before and after 12 weeks of training were given to 78 males. Static strength was measured by the back-pull machine, dynamic strength by the back hyperextension lift. Static strength improved significantly more by training statically than dynamically, and conversely, dynamic strength improved significantly more by training dynamically than statically. There was no significant relationship between improvement in static and dynamic strength. (Author's abstract, modified)

1787
Bowen, H. M.,
and J. M. Gradijan
GRAPHICAL DISPLAY OF MULTIPARAMETRIC INFORMATION. II. EXPERIMENTAL STUDIES OF CHART DESIGN.—Dunlap and Associates, Inc., Stamford, Conn. (Contract AF 33(616)-7965); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6190, Task no. 619006). Technical Documentary Report no. AMRL-TDR-62-115 (II), June 1963. iv+55 p.

Efficient operation of modern weapon systems requires that the operator be given detailed data on system performance characteristics. Such information is frequently presented in graphic and/or tabular form. While there is substantial agreement as to the kinds of performance data required by the operator, there are few rules specifying how such data are best presented for ease and accuracy of interpretation. This report summarizes eight experiments conducted to determine standardized and acceptable formats for portraying multiparametric information. Factors investigated include optimum grid intervals, linear and non-linear functions and scales, chart complexity, and others. (Authors' abstract) (32 references)

1788
Carter, E. T.
and C. E. Billings
NEEDED: SPECIALISTS IN AEROSPACE MEDICINE. III. ACADEMIC AND TRAINING ASPECTS.—New Physician, 12 (4): 130-132. April 1963.

Residency training in aerospace medicine is designed around the concept that prevention occupies just as prominent a place as diagnosis, therapy, and rehabilitation. Prerequisites for residency training are graduation from a medical school and completion of an internship, both of which must be approved by the American Medical Association. Candidates are selected on the basis of their scholastic records, aptitudes, background experience, and personal interview. Specialty training consists of a six-year program which includes three years of formal residency training and three years of practice in aerospace medicine At present, residency programs are being offered both in military and in civilian institutions. The former are usually restricted to career military officers. After the three years of practice, residents can request the examination by the American Board of Preventive Medicine. Upon successfully completing the written and oral examinations, they are certified by the American Board of Preventive Medicine as Diplomates in Aerospace Medicine.

1789
Castruccio, P. A.,
H. L. Loats, and J. A. Modrick
TRAINING AND TRAINING EQUIPMENT REQUIREMENTS FOR GROUND OPERATOR AND MAINTENANCE PERSONNEL OF ADVANCED SPACE SYSTEMS.—Aeronca Manufacturing Corp., Aerospace Division, Baltimore, Md. (Contract AF 33 (616)-6907); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6114, Task no. 611403). Technical Documentary Report no. AMRL-TDR-63-67, July 1963. viii+83 p.

Future propulsion and life-support equipment are identified as requiring new skills due to the adoption of nuclear propulsion and closed-cycle life-support subsystems. Functional changes will occur in guidance/navigation, control, and auxiliary power equipment but no new skills will be required. Tasks required of future guidance/navigation, nuclear propulsion, and life-support technicians are projected. Subsystem composite and component test procedures are described and test equipment, skills and knowledges are identified. A more detailed malfunction and trouble-shooting analysis is presented for closed-cycle life-support equipment. A general outline of training content for these specialties is given and a list of proposed training equipment and aids is coordinated to these outlines. (Authors' abstract)

1790
Chason, L. R.,
and W. D. Thompson
A BIDIRECTIONAL GRADIENT OF GENERALIZED CONDITIONED RESPONSE BASED ON A VISUAL-SPATIAL DIMENSION IN CHIMPANZEES.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 6893, Tasks no. 689301 and 689302). Technical Documentary Report no. ARL-TDR-63-20, July 1963. v+29 p.

Three young chimpanzees, one male and two females, were used to investigate the generalization of chimpanzees on a visual-spatial, bidirectional dimension. The animals were conditioned to a center training light by operant conditioning techniques. The findings revealed that the animals responded to all of the peripheral test stimuli without significant difference in frequency or latency of response. However, significant decreases in response latency were observed (beyond the .01 level) on successive days of experimentation with the lowest latency occurring on the last day. It was concluded that this level of discrimination task-the level being defined by the similarity of test stimuli to the training stimuli, having been varied only on a horizontal, visual-spatial dimension by eight degrees of visual arc-might well be above the liminal discrimination ability of the chimpanzee. (From the authors' abstract) (26 references)

1791
Chkhaidze, L. V.
[GENERAL PRINCIPLES OF SPECIAL PHYSICAL TRAINING OF THE COSMONAUT] Obshchye osnovy spetsial'noi fizicheskoi podgotovki kosmonavta.—Problemy kosmicheskoi biologii (Moskva), 2: 74-79. 1962. In Russian, with English summary (p. 79). 5 refs.

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 78-83. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

The physical training of the cosmonaut should be composed of two parts. The first one would consist of general physical training aimed at the development of both general and special stress tolerance. General tolerance can be increased by various types of cyclic and acyclic exercise (cross-country running, games, etc.). Special training by means of exercises on special apparatus and instruments can be directed at enhancing the stability of the vestibular system and the training of the neuro-muscular system to resist acceleration and deceleration overloads. In addition, it prepares the cosmonaut for coordinated arbitrary movements necessary for control of the space ship in varying gravitational fields.

1792
Colin, J.,
C. Jacquemin, P. Varène, and R. Auffret
[REFLECTIONS ON TRAINING WITH STRATOSPHERIC CLOTHING] Considérations sur l'entraînement au vêtement stratosphérique.—Revue de médecine aéronautique (Paris), 2 (5): 59-64. Nov.-Dec. 1962. In French.

The article does not give new experimental data but reviews the necessity of training pilot candidates with partial-pressure (or altitude) suits, the risks involved, and the corresponding duties of the flight surgeon. A summary is given of the day-by-day candidate training schedule (pressure breathing, decompression chamber), the testing of equipment, and the physiological measurements taken (candidate general appearance, respiratory rate, and cardiac frequency). A description is given of 20 incidents which occurred during such training periods due to faulty equipment, to physiological causes, or to psychological reasons.

1793
Doll, R. E.,
and R. J. Wherry
SEPARATION OF AVIATION OFFICER CANDIDATES FROM CADETS FOR PURPOSES OF PREDICTING VOLUNTARY WITHDRAWALS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-5001, Subtask 1). Report no. 23, March 13, 1963. [11] p.

Prediction of voluntary withdrawal from flight training has been a persistent problem. This study suggests possible reasons for the inefficient prediction of withdrawals and demonstrates that by separating aviation officer candidates and aviation cadets it is possible to obtain a better prediction. (Authors' abstract)

1794
Eckstrand, G. E.,
M. R. Rockway, F. F. Kopstein, and R. L. Morgan
TEACHING MACHINES IN THE MODERN MILITARY ORGANIZATION.—In: Defence Psychology: Proceedings of a Symposium held in Paris, 1960 (NATO Conference Series, 1), p. 170-194; discussion, p. 194-196. Ed. by Frank A. Geldard. Oxford, etc.: Pergamon Press, 1962.

This is a review of the program of research on the teaching machines conducted by the Behavioral Sciences Laboratory of the Wright Air Development Division of the USAF Air Research and Development Command. The following facets of research are considered: (a) development of automated instructional programs and facilities, (b) effective displays of information in training systems, (c) effective ordering of information for automated training, (d) assimilation of information during automated training, (e) motivational aspects of automated training, (f) application of automated training. Some military uses of automated training devices are discussed such as the maintenance of proficiency training in limited-access military installations, on radar sites, in space vehicles, etc.

1795
Gazenko, O. G.,
and V. S. Georgievskii.
[PREPARATION OF AN ANIMAL FOR THE EXPERIMENT] Podgotovka zhivotnogo k eksperimentu.—Problemy kosmicheskoi biologii (Moskva), 1: 321-327. 1962. 12 refs. In Russian, with English summary (p. 327).

Dogs were selected for the space experiments because their physiology is well known and their adaptability has been found to be superior to that of primates. Their training consisted in gradual familiarization with cabin noises and with the instruments attached to them. Particular care was taken to develop means of suppressing defense, orientation, and "freedom" reflexes. The training sessions lasted from a few hours to twenty days. After the training had been completed, no adverse changes were observed, except normal reduction in weight.

1796
Greenspoon, J.
THE EFFECTS ON TRANSFER OF TIME DELAY AND TASK SIMILARITY: A LITERATURE REVIEW.—Florida State Univ., Tallahassee (Contract AF 33(616)-6408); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7183, Task no. 718306). Technical Documentary Report no. AMRL-TDR-63-22, March 1963. iv+21 p.

A review of selected literature pertinent to the effects of similarity and delay on transfer is reported. Emphasis is given to the more recent research and that which seems to make a greater contribution to knowledge of these effects - especially studies in which similarity and time delay were manipulated jointly. Although considerable research has been accomplished, the effects of similarity and time delay (either singly or jointly) are not known with sufficient precision to enable satisfactory use outside of the narrowly constrained laboratory contexts, if even there. Effective prediction on the basis of similarity will depend on the development of a rigorous and reliable technique for its measurement. The effects of delay can only be adequately determined after this is accomplished. (Author's abstract) (59 references)

1797
GROUND TRAINING FOR PILOTS.—Indian Aviation (Calcutta), 37 (4): 95-96. April 1963.

In addition to actual flight training, pilot candidates are exposed to a detailed curriculum of ground subjects at their training centers. They are taught the principles of physics and mathematics as applied to flight, the theories of aerodynamics and aero-engineering, meteorology, air operation, traffic and emergency rules, and familiarized with the airframe, instruments, radio, etc. Other aspects included in the training program are administrative in nature or involve physical training as well as foot, rifle, and weapon training.

1798
Josenhans, W. K. T.
AN EVALUATION OF SOME METHODS OF IMPROVING MUSCLE STRENGTH. — Revue canadienne de biologie (Montreal), 21 (3-4): 315-323. Sept.-Dec. 1962. In English.

One hundred and thirty-two healthy subjects underwent different training procedures over a period of six to eight weeks. The muscle force of grip muscles, flexor, and extensor muscles of index finger, elbow and knee joint were recorded with specially developed hydraulic dynamometers. The findings were as follows: (1) Each muscle contraction produced some gain in muscle force, but this effect decreased with increasing number of contractions per day. (2) The duration and the force of the training contractions had no significant influence on the gain in muscle force. (3) Exercising in open competition produced a significantly higher gain in muscle force than did the same exercise without competition. The relationship of gain in muscle force to gain in endurance is discussed. (From the author's summary) (38 references)

1799
Land, F. L.
AIR FORCE MEDICAL TRAINING PROGRAMS. — GP, 25 (1): 145, 147, 149, 151. Jan. 1962.

The staffing of relatively small Air Force hospitals is directed toward providing a nucleus of general practitioners plus a complement of qualified specialists. Under this system of medical care, general practitioners are given greater responsibility in guiding the complete management of their patients, both military and dependent. To meet the need for additional graduate training, a two-year residency program limited to general practice has been developed at four Air Force regional hospitals. During one year, the resident rotates through internal medicine and allied specialties. The other year is devoted to general surgery, orthopedics, obstetrics-gynecology, anesthesiology, ophthalmology, and otorhinolaryngology. Residents who have completed this training may enlarge their scope of practice to include the programs of aerospace crew effectiveness and missile support by applying to attend the primary Aerospace Medicine course or the Medical Support of Missile Operations course at the Air Force School of Aviation Medicine.

1800
Mooney, C. M.
PERCEPTION AS RELATED TO MILITARY PROBLEMS.—In: Defence Psychology: Proceedings of a Symposium held in Paris, 1960 (NATO Conference Series, 1), p. 260-271; discussion, p. 272-274. Ed. by F. A. Geldard. Oxford, etc.: Pergamon Press, 1962.

Psychological problems associated with perceptual failure under conditions of marked novelty, severe monotony, or excessively unstable environment arise from an inadequate process of perceptual readjustment. In a military setting the maintenance of perceptual equilibrium in face of a crisis becomes of paramount importance not only for efficient observation and communication but also for the perception and appreciation of military situations and for decision-making. Research on the role of the perceptual processes in learning experience is expected to yield certain principles which may possibly be applicable to training in simulated military settings.

1801
Müller, E. A.
PHYSIOLOGY OF MUSCLE TRAINING. — Revue canadienne de biologie (Montreal), 21 (3-4): 303-313. Sept.-Dec. 1962. In English.

Irrespective of the method used for training with progressive isometric contractions, the muscular strength rises more slowly from week to week. The increase in strength ceases if an individual strength, different for different muscles and ways of training, is reached, the so-called strength limit. Only the strength limit makes comparison of the inherent disposition of different muscles possible. The speed of increase in muscular strength from initial strength up to strength limit, expressed in % of that limit, is not influenced by individual factors, such as sex, age, muscle group, level of the strength limit. The speed of increase and the limit of strength are determined, however, by the intensity of training. The main muscles of the body show 83% (group-average 76-88%), muscles rarely used as little as 37% of the strength limit in physically untrained people, when training with one daily maximum contraction of one second. (Author's summary)

1802
Parin, V. V.
[INFORMATION GAINED FROM SOVIET ORBITAL FLIGHTS] Enseignements tirés des vols orbitaux soviétiques.—Revue de médecine aéronautique (Paris), 1 (3): 9-11. March-April 1962. In French.

A review is presented of various Soviet space efforts ranging from the launching of the first artificial satellite "Sputnik" on October 4, 1957, to the orbital flights of astronauts Gagarin and Titov in 1961. These flights provided a means for studying human physiological parameters under actual flight conditions in a closed cabin equipped with a biotechnical system for maintaining life. The astronauts selected were young and in perfect health. Training centered around such fields as physics, astronomy, astro-navigation, aviation and space physiology, construction and equipment of the space ship, communications, etc. During training the physio-psychological state of the astronaut was controlled by numerous psychological, electrophysiological, biochemical, and immunological tests, etc.

1803
SCHOOL OF AVIATION MEDICINE. — Indian Aviation (Calcutta), 37 (4): 103-106. April 1963.

The School of Aviation Medicine in Bangalore, India, trains air force physicians and medical assistants. There are three courses for doctors: introductory, for newly commissioned doctors; primary, for doctors having some service; and advanced, for senior doctors wishing to specialize in aviation medicine. Courses provide training on recognition and management of the effects of the oxygen supply and of low temperatures and pressures on the aircrew. Instruction is also provided in escape and survival problems, cabin temperature and pressure control, the utility and types of flight clothing, accident prevention, neuro-psychiatry, air evacuation of casualties, space flight, medical standards, and procedures of medical examination. New medical officers also learn elementary atmospheric physics and the theory of flight. The primary course runs for 12 weeks, the advanced course for 39 weeks. Instruction of the aircrew in aviation medicine is also conducted by the school of aviation medicine.

1804
See, E. M.
OVERCOMING LIMITS IN SPACE.—IEEE Transactions on Aerospace and Navigational Electronics, ANE-10 (2): 138-141. June 1963.

The astronauts' basic training in space flight centers around studies of spacecraft systems, mechanical and electrical systems, escape systems, reaction controls, and environmental controls. Also stressed are computers, astronomy, meteorology, selenology, and the medical aspects of space flight. In addition to these courses, the astronauts are familiarized with the three space-flight programs (Mercury, Gemini, Apollo) and exposed to training activity on simulators, centrifuge runs, and survival training. Once the indoctrination period is finished the astronauts are assigned to specialty fields.

1805
Slayton, D. K.
HOW WE TRAINED FOR ORBITAL FLIGHT. — Space World, 2 (4): 18-25. March 1962.

An astronaut's training is subdivided into five major categories, each a function of the training devices used: academics, static training, dynamic training, egress and survival training, and specific mission training. Three basic philosophies are adopted as a basic framework: (1) utilization of training devices and methods with even the remotest possibilities for being valuable; (2) make training as difficult as possible even though analytical studies might indicate that a particular task might be relatively easy; and (3) conduct all training on an informal basis except in the interests of intelligent scheduling of instructor and trainer time. Illustrations of the astronauts in training are included.

1806
Slayton, D. K.
[TRAINING OF PILOTS FOR SPACE FLIGHT] Addestramento dei piloti in vista del volo spaziale.— Ulisse (Firenze), 7: 39-47. June 1962. In Italian.

The author, being trained as an American astronaut, discusses the underlying principles and the various phases of astronaut training. One aspect of the training is a thorough familiarization with the technical details of the spacecraft. Exposure to weightlessness is accomplished by parabolic flight in aircraft, exposure to increased acceleration and to rotation on the human centrifuge and other flight simulators. Other phases of the training consist of exposure to increased carbon dioxide tension (up to 4%) in the atmosphere, acrobatic flights in jet planes, athletic activities, underwater swimming, practice in emerging from the space capsule after ditching on water and submersion under water, and training for survival on water.

1807
Sloan, E. P.
RCAF EXPERIENCE WITH THE TRAINING OF NATO AIRCREW.—In: Defence Psychology: Proceedings of a Symposium held in Paris, 1960 (NATO Conference Series, 1), p. 113-125; discussion, p. 125-126. Ed. by Frank A. Geldard. Oxford, etc.: Pergamon Press, 1962.

The international aircrew training program conducted in Canada with more than 7000 aircrew from eleven NATO countries between 1950 and 1957 under the NATO Air Training Plan is analyzed with respect to its organization, pilot training program, and the comparative attrition rates among the different groups. Certain implications drawn for the planning and conduct of similar international training programs are discussed in relation to selection of students, language problems, screening by use of light aircraft training, and the adjustment of the training syllabus to the trainee population. Among the suggestions offered for the future are establishment of a validity exchange program on flight aptitude tests among the NATO defense psychologists, a study of aptitude measurements and selection procedures on a NATO-wide basis, and the development of a selection test battery of a general validity against the criterion of a common training program.

1808
Smode, A. F.,
A. Gruber, and J. H. Ely
THE MEASUREMENT OF ADVANCED FLIGHT VEHICLE CREW PROFICIENCY IN SYNTHETIC GROUND ENVIRONMENTS. — Dunlap and Associates, Inc., Stamford, Conn. (Contract AF 33(616)-7475); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs., Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171003). Technical Documentary Report no. MRL-TDR-62-2, Feb. 1962. vi+120 p.

Major considerations are presented in the design of systems for measuring the proficiency of advanced flight vehicle crews in synthetic ground environments. The measurement techniques described can be used with early groups of trainees, and the norms developed of trainee performance may be of value in refining training standards. A historical outline of aircrew proficiency measurements emphasizing early work and a list of study references on rating methods are also presented. Specifically, these data will be valuable in assisting those individuals directly concerned with simulator training programs, proficiency evaluation and standardization, training standards, and training equipment procurement for advanced flight systems. (118 references)

1809
Vries, E. de
[A NEW VIEW OF THE PSYCHOLOGY OF FLYING] Een nieuwe zienswijze over de psychologie van het vliegen. — Nederlands militair geneeskundig tijdschrift ('s-Gravenhage), 16 (1): 1-10. Jan. 1963. In Dutch, with English summary (p. 9).

In view of the complexity of present-day jet aircraft, the pilot training has to be revised by a trained specialist, an aviation psychologist who is also an experienced pilot. His primary task should be analysis of the flight training methods. The revision must incorporate techniques of elimination and integration of fear, and the building up of a sound and healthy motivation for flying. Only after adequate flying experience and the study of the new training methods will it be possible to propose better selection procedures for pilot candidates.

1810
Weems, P. V. H.
PILOT CLASS IN SPACE NAVIGATION AT THE NAVAL ACADEMY: A REPORT.—Navigation, 9 (4): 259-269. Winter 1962-1963.

A report is given of the first year's work in the newly started course in space navigation at the Naval Academy. A brief history of the inception and some of the class activities are given. Various principles of space navigation such as use of different instruments, position finding, dead reckoning, and the navigator's duties are discussed. Basic concepts and techniques of space navigation have been investigated and proposed by the class. Work done by the class was culminated with its publication of the "Space Navigation Handbook" (NAVPERS 92,988).

1811
White, S.,
and R. B. Voas
[TRAINING FOR SPACE FLIGHT] L'entrainement au vol spatial. — Homme et l'espace (Lausanne), no. 12: 11-15. March 1962. In French.

The astronauts' training program is subdivided into 5 principal categories: (1) a theoretical course in mechanics, aerodynamics, astronomy, meteorology, astrophysics, geophysics, physiology and human anatomy; (2) training on static apparatus such as cabin simulators; (3) training on dynamic apparatus including weightlessness experiments on the human centrifuge; (4) safety and survival operations; and (5) training in view of the mission. Included are photographs of the United States Naval and Soviet human centrifuges, and simulated flight chamber tests.

d. Performance and Fitness

[*Physical fitness tests under 8-f*]

1812
Andersen, K. L.,
R. E. Elsner, B. Saltin, and L. Hermansen
PHYSICAL FITNESS IN TERMS OF MAXIMAL OXYGEN INTAKE OF NOMADIC LAPPS. — Inst. of Work Physiology, Oslo, Norway (Grant no. AF-EOARDC-61-32); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8240-19). Technical Documentary Report no. AAL-TDR-61-53, June 1962. iv+32 p.

Physical fitness in terms of aerobic working capacity was measured in nomadic Lapps living in the northern part of the Scandinavian peninsula. Forty-nine men between 10 and 55 years of age and 21 girls were studied. Aerobic capacity was determined by measuring oxygen consumption during exercise on a bicycle ergometer. Two or three submaximal loads were used. The maximal work lasted three to four minutes, during which time the subjects worked as hard as they could. Blood lactate taken after this heavy run showed that the oxygen requirement exceeded oxygen intake, thus indicating that maximal values for oxygen intake were achieved during this type of exercise. The values for maximal oxygen intake of nomadic Lapps increased steadily from the age of 10 up to 18 years, from an average of 1.4 liters/minute to about 3.5 liters/minute. The latter value remained essentially unchanged up to the age of 30 in men. Maximum oxygen consumption then decreased to about 2.5 liters/minute at 50 years of age. No sex differences in maximum oxygen consumption were noted in subjects below 15 years of age. (Authors' abstract) (25 references)

1813
Balke, B.
A SIMPLE FIELD TEST FOR THE ASSESSMENT OF PHYSICAL FITNESS. — Federal Aviation Agency, Civil Aeromedical Research Inst., Oklahoma City, Okla. Report no. 63-6, April 1963. 8 p.

An essential factor in air safety is the physical and mental fitness of all personnel directly involved in operations of general, commercial, and military aviation. Standardization and classification of fitness, however, have not been established to a degree which would allow for much more than a differentiation between "normal" health and pathological disturbances. Testing a large population - important for the establishment of standards - requires test procedures of simple design but capable of rendering results which are comparable to those of more complex and time consuming laboratory tests. Experiments have indicated that a 15-minute best-effort run can be utilized as substitute for a standard work capacity test in the laboratory. This type of test constitutes a satisfactory assessment of the potentially available functional reserves. (Author's abstract)

1814
Bernstein, A. J.
DEVELOPMENT AND EVALUATION OF A SIMULATOR FOR EVALUATING TROUBLESHOOTING PERFORMANCE ON A COMPLEX ELECTRONICS SYSTEM. — IRE Internat. Convention Record, 10 (9): 192-199. 1962.

As a result of the high availability requirement on the Atlas Radio-Command Guidance System, it is important to maintain peak proficiency of the in-line maintenance crews. However, since faults in the system occur at relatively low frequency, the crews are not able to maintain their troubleshooting skill through the natural conduct of their work. While in some systems maintenance crew proficiency has been maintained by "bugging" the line equipment, such a procedure on the Atlas system would have very deleterious effects on the weapon's availability. As a consequence, a simulator was developed to enable periodic exercising and evaluation of personnel in system troubleshooting. (Author's summary)

1815
Berry, C. A.
VISUAL STANDARDS FOR AND PROBLEMS OF SPACEFLIGHT. — Med. Jour. Australia, 2: 674-677. Oct. 19, 1963.

The visual selection standards for astronauts, protection measures, and environment expected during space flight are discussed. The following visual problems are discussed: decreased luminance, glare from Earth, the Sun's rays, ultraviolet rays, Van Allen belt radiation, weightlessness, and space myopia. John Glenn's comments concerning his visual activity during the Friendship 7 flight (1962) are quoted. Selection standards are given for visual acuity, accommodation, depth perception, visual field, refractive index, intra-ocular fluid dynamics, night vision, heterophoria, and fusional amplitudes. In view of the importance of vision as the prime sensor in space, high standards of visual function efficiency must be required of potential astronauts.

1816
Buckhout, R.
A BIBLIOGRAPHY ON AIRCREW PROFICIENCY MEASUREMENT. —— Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171003). Technical Documentary Report no. MRL-TDR-62-49, May 1962. iv+25 p.

Reports on aircrew proficiency measurement are compiled in the interest of research on the problem of assessing the performance of combat aircrew members. Particular emphasis has been placed on material related to the potential use of ground-based flight simulators as sophisticated, objective aircrew-proficiency measurement tools. The reports are listed under six sections: First Order Measurement, Combination Measures, Validation, Measurement Equipment, General Analyses and Reviews, and Background Reports. All of the reports have been coded in accordance with their relevance to kinds of aircrew tasks and to aircrew positions. (Author's abstract) (234 references)

1817
Chambers, R. M.,
and R. Fried
PSYCHOLOGICAL ASPECTS OF SPACE FLIGHT.— In: Physiology of man in space, p. 173-256. Ed. by J. H. U. Brown. New York and London: Academic Press, 1963.

This chapter, which presents the psychological aspects of space flight, reviews the scientific literature in these problem areas: (1) Psychological requirements for man is space; (2) Sensing and perceiving; (3) Perceptual and motor skill performance; (4) Cognitive processes and other higher mental abilities; (5) Personality and emotional behavior; (6) Psychological aspects of astronaut selection; and (7) Psychological conditioning and training. The first five of these are basic research areas in which psychologists conduct experiments to determine the abilities and capabilities of man in space environments. The last two areas are more concerned with the application of psychological principles to improve the reliability of man for serving as a functional component within the manned space flight system. (196 references)

1818
Crane, D. G.
PSYCHIATRIC EVALUATION OF SPACE FLIGHT. —— Jour. Indiana State Med. Assoc., 55 (11): 1623-1627. Nov. 1962.

The reaction of man to his new environment in space travel is essentially an unknown in space progress. An analysis of the stresses suggests that evaluation of the emotional stresses may be of great significance since they are less amenable to experimentation. An alternative is the psychiatric screening of the future astronauts through standard dynamic interviews and psychological tests considering also their behavior in stress situations of the past and during experimental stresses of isolation and brief periods of weightlessness. Psychiatric interviews have suggested that the more successful candidates appear to be comfortable, mature, and well-integrated individuals. A less foreseeable stress may be separation anxiety in the wake of leaving Earth with the symbols of familiar aspects of the individual's existence. Any personality defects which have been masked or compensated for successfully previously may become magnified under unusual stresses and interfere with his function, as shown by experiments with simulated space flight conditions.

1819
Elliott, L. L.
HEARING OF AIR FORCE PILOTS: 1955 TO 1962. —— School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775503). Technical Documentary Report no. SAM-TDR-62-127, Dec. 1962. iii+6 p.

This report surveys the hearing levels of all Air Force pilots examined at the School of Aerospace Medicine from 1955 through mid-April 1962. Pilots are found to have generally superior hearing when compared by age groups with hearing levels of two comparison groups. (Author's abstract)

1820
Flandrois, R.,
R. Puccinelli, P. Galban, and Y. Houdas
[MAXIMAL OXYGEN CONSUMPTION AND PHYSICAL FITNESS OF FLYING PERSONNEL] Consommation maximale d'oxygène et aptitude physique du personnel navigant. —— Revue de médecine aéronautique (Paris), 1 (4): 63-65. July-Aug. 1962. In French.

Forty-three males between 18 and 23 years of age, mostly flight candidates not physically trained and not participating in active sports, were exercised on a bicycle ergometer. Determination of the maximal oxygen consumption showed an elevation of 3.00 liters/minute or 47 ml./kg./minute. Maximal cardiac frequency during intense exercise was 192 systoles per minute. The theoretical aerobic capacity was determined by Astrand's abacus starting with the subject's weight and his cardiac frequency measured during the modified Harvard step-test. A good correlation was found between experimental aerobic and theoretic capacities. These results need additional study; however, they indicate the value of the Astrand method for determining physical fitness in flying personnel for purposes of selection and control.

1821
Foulkes, R. G.
COMPULSORY MEDICAL EXAMINATION OF "APPARENTLY WELL" R.C.A.F. SENIOR NON-COMMISSIONED OFFICERS OVER THE AGE OF FORTY YEARS - A REPORT ON 31 CASES. —— Canad. Services Med. Jour. (Ottawa), 18 (3): 179-186. March 1962.

A group of 31 senior non-commissioned officers of the Royal Canadian Air Force who were "apparently well" were examined, compulsorily, between November 1959 and March 1960. Abnormalities found, and tabulated, include those of the eye, ear, skin, blood, cardiovascular, respiratory, digestive, and musculo-skeletal systems, obesity, anxiety, and alcoholism. Conditions were discovered, that, if not kept under observation or placed under treatment, could terminate in serious morbidity with consequent hospitalization and time loss. The cost of examination per individual was estimated at less than $25, a good investment if serious disease is prevented and the individual retained in full working capacity until retirement. (Author's summary, modified)

1822
Grimby, G.,
and B. Söderholm
SPIROMETRIC STUDIES IN NORMAL SUBJECTS. III. STATIC LUNG VOLUMES AND MAXIMUM VOLUNTARY VENTILATION IN ADULTS WITH A NOTE ON PHYSICAL FITNESS.—Acta medica scandinavica (Stockholm), 173 (2): 199-206. Feb. 1963.

Static lung volumes and dynamic function tests were studied in normal men and women. Equations and nomograms for total lung capacity, functional residual capacity, and the maximum voluntary ventilation for the prediction of normal values and their limits are presented. In the male group physical fitness was studied on a bicycle ergometer. No correlations were found between spirometric data and the working capacity as judged from heart rate at submaximal work loads. (Authors' summary)

1823
Harlan, W. R.,
A. Graybiel, and R. K. Osborne
LONGITUDINAL STUDY OF HEALTHY YOUNG MEN FOLLOWED OVER AN EIGHTEEN-YEAR PERIOD.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3001, Subtask 2). Report no. 5, Sept. 24, 1962. ii+15 p.

A longitudinal study carried out over an eighteen-year period is described and a report on the physical status of the group, with particular attention to the influence of flying, is given. The 1056 healthy young men were initially studied after entering the United States Navy flight program. With the exception of death and injury directly related to flying, there was no difference in the incidence of symptomatic disease or physical abnormalities between the group continuing as aviators and groups never qualifying as aviators or flying less than five years. Flying was found to be neither directly detrimental nor contributory to the development of vascular or nonvascular disease. Longitudinal features of blood pressure and electrocardiograms in the evaluation of flying personnel are reviewed. (Authors' summary, in part)

1824
Hebbard, F. W.
CONTACT LENSES IN CIVIL AVIATION: CURRENT STATUS.—Jour. Amer. Optometric Assoc., 34 (8): 618-622. March 1963.

No mention is made of contact lenses in the Federal Aviation Agency visual regulations. The civil air surgeon has therefore followed the policy of permitting the wearing of contact lenses while flying only for first class (commercial airline pilots) and second class (commercial, non-airline aircraft pilots) medical certificate holders who have a unilateral deficiency which can be corrected with a contact lens to give 20/20 vision, provided that the deficient eye has an uncorrected acuity of at least 20/50. While the Aviation Medical Service discourages the wearing of contact lenses by holders of third class certificates (pilots of private aircraft), it permits them to be worn if the patient's optometrist or ophthalmologist furnishes a report indicating that the patient can wear them suitably. Some problems associated with contact lenses which can cause the wearer difficulty are: (1) possible popping-out of the eye; (2) they give poorer vision than spectacles in some instances; (3) cockpit fumes may cause eye irritation; (4) depth perception is sometimes different. The advantages of wearing contact lenses include: (a) freedom from fogging in the cold; (b) they provide a wider visual field in larger refractive errors; (c) no induced peripheral prism for anisometropes; and (d) they are less likely to be blown off in the slipstream than spectacles. The policy of contact lenses for non-certified air personnel, such as stewardesses, is determined by the individual airline.

1825
Keeling, J.
A SURVEY OF SUCCESS OF A PILOT IN TERMS OF VISUAL STANDARDS. —Jour. Royal Naval Med. Service (London), 48 (2): 63-64. 1962.

Also published in: Revue de medecine aeronautique (Paris), 1 (4): 46-49. July-Aug. 1962. In English.

A survey was made of the progress of 459 volunteers accepted for pilot training. 359 of the candidates had normal vision, 75 had acuity below 6/6, 6/6, and 25 attained ocular muscle balance standards only after orthoptic treatment. The rates for confirmed over-all success as pilots are given as 49% for those with normal vision, 30% for those with subnormal acuity, and 23% for those who received orthoptic treatment. In absolute numbers, and grouping together the two forms of visual deficiency, of the 100 men with such deficiency who attempted flying, only 7% achieved an above-average professional assessment, and 4% showed no assessment as yet. Of the 359 with normal vision, an above-average assessment was given to 65 (18%). Analysis of the results of refraction, and of the different forms of heterophoria, does not indicate that the clinical condition points to lack of success. No matter what the underlying clinical defects, the possessors of subnormal eyesight have only about half the chance of becoming successful pilots by comparison with other visually normal contemporaries.

1826
Kuehnel, H. A.,
W. O. Armstrong, J. J. Van Bockel, and H. I. Johnson
PILOT PERFORMANCE. — In: Results of the second United States manned orbital space flight, May 24, 1962, p. 63-68. Washington, D. C.: National Aeronautics and Space Administration, 1962.

The results of the MA-7 orbital flight of astronaut M. Scott Carpenter indicate that man can function effectively in a space environment for periods up to 4 1/2 hours. The pilot demonstrated his ability to operate scientific apparatus successfully in a space environment and to obtain useful data for the analysis of scientific problems associated with a terrestrial space environment. The results of the flight provide additional evidence that man is ready for a more extended mission in a weightless environment. Flight difficulties occurring during the mission served to emphasize that the primary attention of the pilot be devoted to management of spacecraft systems and detailed attention to operational functions. (Authors' summary, modified)

1827
Lomonaco, T.
[THE PROBLEM OF NUTRITION IN THE COMMUNITY (ESPECIALLY THAT OF AERONAUTICS)] Il problema alimentare nelle collettività (specialmente in quella aeronautica). —Rivista di medicina aeronautica e spaziale (Roma), 25 (3): 549-557. July-Sept. 1962. In Italian, with English summary (p. 555-556).

The nutritional problems of a typical community, similar to the Air Force, are briefly discussed in terms of the following: (1) caloric intake in relation to age, intensity of work, and temperature conditions of the work environment; (2) quantitative and qualitative balance of the various components of the daily food ration; (3) elimination of every cause of food contamination or deterioration, including factors arising from ionizing radiation; (4) qualitative and quantitative structure of the food ration; and (5) comfort of the daily dining area and suitability of the food.

1828
Mathews, C. S.
UNITED STATES EXPERIENCE ON THE UTILIZATION OF MAN'S CAPABILITIES IN A SPACE ENVIRONMENT.—In: Life sciences and space research, p. 141-159. Ed. by R. B. Livingston and others. Amsterdam: North-Holland Publishing Co., 1963.

This paper concerns the stresses on the flight crew in various phases of space flight missions and the ability of the crew to perform piloting-type tasks and other specific operations during flight. The stresses of the space environment are caused by forces and/or motions or lack thereof, the space environment itself, the environment within the spacecraft, and the mental and physical demands on the flight crew. Among crew functions are control of the onboard systems, navigation and guidance of the spacecraft, maintenance and emergency operation, communications, and the conduct of scientific experiments. The paper draws on information obtained from the flight research to date as well as from ground tests and analyses. From the results one can conclude that man can very ably withstand the stresses of short-duration missions into near space and has demonstrated ability to perform the type of tasks associated with flight crew operation. The chief unknown factors of future flight operations are the stresses produced by longer-duration missions. Consideration of the problems involved leads to the conclusion that they are amenable to engineering solution at some expense to spacecraft weight and performance. (Author's abstract, in part)

1829
Mercier, A.,
and G. Perdriel
[OPHTHALMOLOGICAL PROBLEMS CAUSED BY USE OF HELICOPTERS AND APPARATUS FOR VERTICAL TAKE-OFF AND LANDING] Les problèmes ophthalmologiques posés par l'utilisation des hélicoptères et des appareils à décollage et atterrissage verticaux. — In: Visual problems in aviation medicine, p. 89-94. Ed. by A. Mercier. Oxford: Pergamon Press, 1962. In French, with English summary (p. 93-94).

Helicopter pilots require perfect stereoscopic vision in order to determine vertically the altitude, relief, and slope of the ground. Therefore, any refractive defects, especially myopia and myopic astigmatism, must be corrected. Helicopter piloting requires constant visual effort, and during certain missions atmospheric turbulence at low altitude or sound vibrations increase visual fatigue. The stroboscopic effect of the rotor blades has been responsible for some cases of photogenic epilepsy. Predisposition to this condition may be detected by means of electroencephalography with intermittent light stimulation. Vertigo often occurs in pilots as a result of increases in speed whereby objects seem to pass by, and of hovering flights at higher altitudes. Vertical take-off and landing aircraft may produce dense clouds of dust and impair outside visibility. Consideration is given to protective lenses for the helicopter pilot's eyes in relation to the mission. (Authors' summary, modified)

1830
Mercier, [A.]
[SPACE MYOPIA] La myopie spatiale. — Revue de médecine aéronautique (Paris), 1 (4): 65-68. July-Aug. 1962. In French.

Accommodative spasm for near sight associated with high-altitude flight in aviators in the so-called empty visual field is thought to cause space myopia. This type of myopia does not appear only during high-altitude flight but also during the visual surveyance of vast sea or desert areas, snow-covered plains, or during flight between two cloud layers; in other words, every time the eye finds it impossible to focus at a distance. A proposal not to admit hypermetropic student pilots of 1 diopter to fighter school was studied. Of 42 emmetropic, hypermetropic, or myopic subjects, the myopics were found to be less susceptible to hyperaccommodation in an empty visual field than hypermetropics. All factors affecting the mechanisms of accommodation vary according to the individual and the situation. Visual aids to combat accommodative spasm are ineffective. It is suggested that the following procedures be adopted: navigation control with flight plans regulating the altitudes and corridors of commercial air traffic, and the installation of radar on board military aircraft permitting observation of the sky without relying on distance vision.

1831
Morris, F. M.
CONTACT LENSES IN AVIATION AND SPACE.— Jour. Amer. Optometric Assoc., 34 (8): 623-627. March 1963.

A brief review is presented of U. S. Air Force research projects (1950, 1952, 1955) concerned with contact lenses. A Contact Lens Center was established in 1958 at the School of Aviation Medicine for fitting flying personnel with contact lenses. The use of contact lenses among flying personnel provides some advantages: (1) although rare in flying populations, irregular astigmatism, aphakia, and aniseikonia are benefitted; (2) they are easy to use in conjunction with oxygen mask, flying helmet, or pressure suit faceplate; (3) no fogging or spectacle soiling; and (4) no visual field restriction as imposed by frames and no inability to position the eye close to the eyepiece of navigational and other instruments. Disadvantages include: (a) limitations of physiological tolerance to wearing of contact lens may produce incapacitating painful abrasions and/or corneal edema with marked visual impairment; (b) accidental loss or dislodgment of lenses in flight causes blur; (c) decrease in visual acuity over that attained with spectacles; and (d) occasional drying of lens between blinks causes "on-off" type of vision. Prior to acceptance as a candidate for wearing contact lenses, flying personnel are interviewed and carefully screened by their respective flight surgeons. The use of contact lenses in space flight or space exploration is contraindicated. The physical standards presently governing astronaut selection preclude the existence of refractive error. During orbital flights, astronauts will wear pressure suits, thereby inhibiting removal, cleaning, or insertion of contact lenses.

1832
Nicks, D. C.,
and E. A. Fleishman
WHAT DO PHYSICAL FITNESS TESTS MEASURE?—A REVIEW OF FACTOR ANALYTIC STUDIES. — Educational and Psychol. Measurement, 22 (1): 77-95. Spring 1962.

This review describes fourteen factors of physical proficiency identified from previous research (Explosive Strength, Dynamic Strength, Static Strength, Extent Flexibility, Dynamic Flexibility, Speed of Change of Direction, Running Speed, Speed of Limb Movement, Static Balance, Dynamic Balance, Balancing Objects, Multiple Limb Coordination, Gross Body Coordination, Endurance). A number of questions are raised regarding the structure of skill in this area and suggestions are made for future studies to answer these. Existence of a general factor of "physical proficiency" is ruled out in favor of a multi-dimensional composite of skills. Further studies are planned to clarify the structure of physical proficiency, to identify new factors which may emerge, and to develop a battery of basic reference tests which provides a comprehensive coverage of abilities in this area. (84 references)

1833
Niess, O. K.
THE ROLE OF THE U. S. AIR FORCE IN INTERNATIONAL MEDICINE. — Military Med., 127 (12): 1004-1006. Dec. 1962.

Because Air Force bases are widely dispersed around the world, Air Force physicians play a major role in improving international health standards, bringing medical care and training to laymen and physicians, and assisting the host governments in times of disaster. To keep airmen and their families healthy, environmental health laboratories have been established for on-the-spot analyses of water, gases, fumes, biological fluids, and industrial wastes. In addition, each year the Air Force invites physicians from world capitals to inspect its medical research facilities throughout the U.S., attend courses in aviation and space medicine, and observe new techniques and specialties.

1834
Osborne, R. K.,
W. R. Harlan, and A. Graybiel
A LONGITUDINAL STUDY OF HEALTHY YOUNG MEN: CORRELATION COEFFICIENTS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3001, Subtask 2). Report no. 7, July 15, 1963. ii+9 p.

A longitudinal study of a group of healthy young men (aviators) followed over an 18-year period is described. The relationships among data from three examinations of this group are presented in the form of correlation coefficients. A correlation matrix of 106 continuous variables is recorded as a reference for other investigators. Pertinent statistical considerations are outlined and briefly discussed. (Authors' abstract)

1835
Pinto, R. M. N.
[SURGERY FOR OTOSCLEROSIS AND FLIGHT ACTIVITY] Cirurgia da otosclerose e atividade aerea. — Revista medica da aeronautica (Rio de Janeiro), 14 (1-4): 15-23. Jan.-Dec. 1962. In Portuguese, with English summary (p. 21).

Flight candidates having had otosclerosis surgery by procedures such as stapes mobilization, fenestration, or stapedectomy should be permanently disqualified from flight training. Aircrewmen having undergone otosclerosis surgery by conservative stapes mobilization procedures may be kept on flight duty. Aircrewmen with previous fenestration or stapedectomy, maintaining normal middle ear aeration, normal labyrinthine equilibrium and coordination, and adequate hearing may remain on flying status with restrictions. These persons may fly transport missions and be accompanied by another man who can substitute in the event of incapacitation during flight. Furthermore, these persons must undergo an otorhinolaryngological examination every four months, or at shorter intervals if necessary, and permanent or temporary disqualification for flight duty should be granted in the event of the appearance of any otological complications.

1836
Price, T. J. G.
VISUAL STANDARDS IN THE SELECTION OF FLYING PERSONNEL. — In: Visual problems in aviation medicine, p. 95-105. Ed. by A. Mercier. Oxford: Pergamon Press, 1962.

A discussion is presented, with tabulations, of the visual acuity standards for various categories of pilots and aircrew members, and of the ancillary standards for ocular muscle balance, convergence and accommodation, depth perception, and color vision. The importance of strict eye examination is emphasized whether it is for the renewal of civil flying licenses, the initial acceptance of aircrew for training, the problems of the ageing crew member, or the younger members who fall below the high level of visual efficiency.

1837
Ryack, B. L.,
and E. S. Krendel
EXPERIMENTAL STUDY OF THE NATURAL PILOT FLIGHT PROFICIENCY EVALUATION MODEL.—Franklin Inst., Engineering Psychology Branch, Philadelphia, Pa. (Contract N61339-323); issued by Naval Training Device Center, Port Washington, N.Y. Technical Report no. NAVTRADEVCEN 323-2, April 1963. vi+38 p.

A series of investigations evaluating "adaptability" and "conservation of effort" as parameters of tracking performance is described. Twenty-four subjects with known levels of tracking proficiency and experience were required to perform a compensatory tracking task first under conditions of changing controlled element dynamics and then under conditions of intermittent target presentation. In all cases where stable measures were obtained, the proficient trackers retained their superiority over the poor ones. In the case of one measure, the proficient trackers suffered less decrement in performance as a result of changing dynamics than did the poor trackers, but in all other measures the decrements due to changing dynamics or intermittency were the same for the proficient and the poor trackers. Additional training had no effect upon performance under any of the experimental conditions. The results support the hypothesis that adaptability and conservation of effort are important parameters of system performance. The results also show that these two measures are not correlated and therefore tap independent aspects of proficiency.

1838
Steininger, K.
[PSYCHOLOGICAL CAUSES OF FLIGHT ERRORS IN THE TRAINING OF PROFESSIONAL PILOTS] Psychologische Ursachen von Flugfehlern in der Ausbildung von Berufsflugzeugführern.—Zeitschrift für experimentelle und angewandte Psychologie (Göttingen), 9 (4): 667-700. 1962. In German, with English summary (p. 697-698).

The psychological factors involved in flight errors committed by student pilots during their training are analyzed from the standpoint of flight instruction. The importance of motivation for successful flight training is stressed. Casual relationships are emphasized as seen in the influence of anxiety on perception and attention, on control movements, and on air-sickness. The presence of the instructor often impairs the efficiency of the student pilot, particularly during examination, and affects the stability of flying efficiency. Flight evaluations by the instructor and reasons given for dropping out of the training often do not reveal the psychological factors which lead to failure. This report deals with psychomotor reactions and perception as pertaining to lack of talent as a source of flight errors. It was found that differences in abilities with regard to sensorimotor skill may be compensated for by training. However, psychomotor disturbances in movements of controls during flight are mostly an expression of psychic stress or undue strain on attention. Perceptual sources of errors are investigated as far as they are involved in the misinterpretation of imperfect signals, in demands on attention by the presentation of excessive information, and in the lack of understanding of spatial relations. (From the author's summary)

1839
Teel, K. S.,
and R. L. Petersen
A STUDY OF TEST-RETEST RESULTS OBTAINED ON AIRCREW PROFICIENCY EXAMINATIONS. —Jour. Psychol., 53 (2): 289-294. April 1962.

Examination of 112 test-retest scores obtained from aircrew proficiency examinations showed an improvement of less than 5% upon retest. The time elapsed between test and retest in this study (42 to 237 days) had no significant effect. Low scorers on the first test showed the greatest improvement in retest scores suggesting that motivation plus intensive preparation are more important factors in their retest improvement than the recall of specific test items.

e. Duties

1840
Borrey, F.,
J. Robion, G. Lambert, and J. Fessard
[OCCUPATIONAL MEDICINE, SUCH AS CAN AND MUST BE CONSIDERED IN THE AVIATION SERVICE] La médecine du travail, telle qu'elle peut et doit être envisagée dans l'aviation marchande.—Presse médicale (Paris), 70 (34): 1661-1665. July 14-21, 1962. In French.

The role of the flight surgeon is to diagnose and treat the general disorders of flying personnel and those disorders especially related to the profession of flying. Moreover, he must study the work areas of flying personnel and consider the hygienic, physiological, and psychological factors necessary to improve them. The flight surgeon is also responsible for the selection of candidates and survey of personnel by medico-psychological methods, for the study of incidents and aircraft accidents in view of their prevention, organization and maintenance of a corps of medical personnel, and for the documentation of medical information.

1841
DeLay, W. R.
MISSILES AND MEDICAL OFFICERS: THE AIR FORCE LOOKS AT GENERAL PRACTICE. —GP, 27 (3): 193, 195, 197, 199. March 1963.

The basic medical officer of the Air Force, the flight surgeon, is a general practitioner with training in aviation medicine. He is the "family" doctor of the operational squadron crew, and of members of their family. There are 1500-1600 flight surgeons stationed at military posts throughout the United States and in foreign countries. There is a shortage in flight surgeons because not enough medical graduates are seeking careers in general practice training.

1842
Lomonaco, T.
[PRESENT MISSIONS OF THE AEROMEDICAL SERVICE] Compiti attuali del servizio sanitario aeronautico. —— Rivista di medicina aeronautica e spaziale (Roma), 25 (5): 5-23. Jan.-March 1962. In Italian, with English summary (p. 20-21).

The mission of the aeromedical service is to: (1) prevent and treat diseases and injuries of flying personnel; (2) improve the psycho-physical fitness of flying personnel, especially of pilots and specialists, for more efficient work performance; (3) control the psycho-physical training of flying personnel; (4) engage in technical and professional instruction and improvement of aeromedical personnel; and (5) undertake studies and research in aviation and space medicine and in related biological sciences.

1843
THE MANY HATS OF THE MILITARY VETERINARIAN. —— Modern Veterinary Practice, 43 (4): 27-30. April 1962.

In the area of preventive medicine, the veterinary officer is an integral component of troop health programs, including food handling, waste disposal, nutrition requirements, area sanitation, and control of zoonoses. He is also responsible for the health of Government-owned animals, notably those utilized in medical and space research programs and sentry dogs. The military veterinarian is a team member, along with medical and other scientists, in all aspects of medical research and development, including disease problems, basic research in physiology and pathology, radiation biology, and space medicine.

1844
Niess, O. K.
OPTOMETRIC ROLE IN THE AEROSPACE AGE. —— Jour. Amer. Optometric Assoc., 33 (7): 509. Feb. 1962.

Optometrists assigned to the School at the Aerospace Medical Center, U. S. Air Force, are engaged in: (1) research in areas affecting the health and performance of fliers, (2) training activities in aerospace medicine, and (3) medical consultation. Research projects include the following areas: determination of the threshold retinal thermal dosage, development of photochemical self-attenuating variable-density filter material, and a feasibility study of corneal contact lenses for flying personnel.

1845
NURSES IN OUTER SPACE. —— Science News Letter, 81 (14): 215. April 7, 1962.

Air Force nurses are preparing for space evacuation missions requiring a new approach in the gravity-free environment above the earth's atmosphere. While actual space nursing is still in the future, Air Force nurses now provide medical ground support for the men at missile bases and launch pads.

1846
Thomas, S.
SPACE DOCTOR. —— Space World, 2 (4): 32-33, 58-59. March 1962.

Keeping the astronauts alive and healthy in the hostile reaches of cislunar space is the challenging job of General Don Flickinger, Assistant for Bioastronautics. As both scientist and physician he is concerned with the problems of the spaceman in the weightless state and exposure to the hazards of radiations as well as with the toxicological aspects of missile sites and the ground crew's medical problem.

f. Attitudes and Morale

1847
Harding, F. D.,
and R. A. Bottenberg
ATTITUDES AND CAREER INTENTIONS OF OFFICER TRAINING SCHOOL STUDENTS.— Aerospace Medical Division. Personnel Research Lab. (6570th), Lackland Air Force Base, Tex. (Project no. 7719, Task no. 771902). Technical Documentary Report no. PRL-TDR-62-8, May 1962. iii+8 p.

Questionnaire responses indicating attitudes of students toward an Air Force career were analyzed for 12 Officer Training School (OTS) classes. Results indicate that about 35% of the students plan to make a career of the Air Force. The chief reasons for applying for OTS were identified as prestige and status of being an Air Force officer and the opportunities for travel and additional education. Using responses to selected items of the questionnaire which could become available at the time the candidate applies for OTS, it was possible to develop a Retainability Score which was highly indicative of the OTS graduate's intent to make the Air Force a career. (Authors' abstract)

1848
Laroche, de B. de
[EVOLUTION OF MOTIVATION FOR THE FIGHTER PILOT] Evolution de la motivation pour le pilotage de chasse.—In: Defence Psychology: Proceedings of a Symposium held in Paris, 1960 (NATO Conference Series, 1), p. 127-132; discussion, p. 132-133. Ed. by F. A. Geldard. Oxford, etc.: Pergamon Press, 1962. In French.

A hierarchic analysis is described, utilizing factorial techniques, which compare the motivation of fighter pilots with regard to various attitude scales (motivation for flight, inclination towards risks, etc.) and their development. Certain analogies of content and structure were observed in the data, especially the maximum intensity of motivation in flight candidates and confirmed pilots, in relation to other psychological dimensions: inclination towards risks in the first group, negation of apprehension or fatigue in the second. The values implicated were very different and appeared to reflect many personality aspects and ultimately the effects of the group. Motivation of beginning candidates did not constitute a prediction for success in flight school. Hierarchic analysis is of value in the psychotechnical selection techniques, and in the evaluation of the effects of training, environmental conditions, and latent conflicts or antagonisms for each of the attitude scales considered.

g. Personal Factors (Age, Sex, Race, Body Measurements, etc.)

1849
Allen, M. F.,
and D. A. Clark
SERUM LIPID AND LIPOPROTEIN CONCENTRATIONS IN MILITARY ACADEMY GRADUATES: TRENDS FROM 1952 THROUGH 1960.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no.775301). Technical Documentary Report no. SAM-TDR-63-28, April 1963. iii+7 p.

Biennial measurements of serum cholesterol, phospholipid, low- and high-density lipoprotein concentrations, and body weight are recorded for a group of more than 400 men who have been followed from average age 19.6 through 27.5 years. In general, serum lipid and low density lipoprotein concentrations increased between 1952 and 1958, and either remained unchanged or decreased slightly between 1958 and 1960. The high density lipoprotein concentration decreased in each sample year since first measured in 1956. (Authors' abstract)

1850
Birren, J. E.,
K. F. Riegel, and D. F. Morrison
AGE DIFFERENCES IN RESPONSE SPEED AS A FUNCTION OF CONTROLLED VARIATIONS OF STIMULUS CONDITIONS: EVIDENCE OF A GENERAL SPEED FACTOR. — Gerontologia (Basel), 6 (1): 1-18. 1962.

Young (18-30 years) and elderly (60-80 years) persons were subjected to a total of 22 experimental conditions ranging from simple movement and reaction times, through numbers, letters, colors, symbols, and word relationships of a predetermined nature. Under all experimental conditions the elderly subjects were slower than the young. Age differences in speed of response were not limited to the simple motor aspects of tasks but involved to an even greater extent verbal process. The results in general support the view that older subjects tend to show a characteristic slower response speed, whereas young adult subjects are more task-specific in their response speed. Although the spatial order of stimuli and responses was changed for each experimental condition, the 22 conditions were always performed in the same order. For this reason any adaptation of the subjects to the experiment might result in somewhat better performance of the later and more complex conditions. (Authors' summary, modified)

1851
Broadbent, D. E.,
and A. Heron
EFFECTS OF A SUBSIDIARY TASK ON PERFORMANCE INVOLVING IMMEDIATE MEMORY BY YOUNGER AND OLDER MEN. — Brit. Jour. Psychol. (London), 53 (2): 189-198. May 1962.

Many practical situations expect a man to seek out and respond to signals, while at the same time remembering which signal is the one now requiring response. Most situations devised by psychologists, on the other hand, examine either reaction to signals without memory, or memory without reaction. A task has been devised in which both functions are involved. It consists of sets of random numbers which are observed through a small slot allowing only a few numbers at a time to be visible. The subject has to cross out particular digits, and has to remember which digit he is seeking at any particular instant. This type of task is compared with a more conventional number crossing task in which the subject has to find all instances of one particular digit, and both types of task are performed with and without an additional auditory distraction. In the present experiment, conducted with groups of young and of old subjects, it was found that the tasks involving memory are very vulnerable to distraction. The older subjects differed greatly among themselves, some being seriously inferior in performance to younger subjects; no such difference in variance appears in the similar task without memory load. When a distracting task is presented together with a main task involving memory, older subjects do very badly at one or the other, whereas young subjects do reasonably at both. (Authors' summary)

1852
Brüschke, G.,
and H. Herrmann
[CHANGES IN THE WHITE BLOOD CELL SYSTEM DUE TO AGING] Alternsabhängige Veränderungen im weissen Blutzellsystem.—Gerontologia clinica (Basel), 5 (1): 45-51. 1963. In German, with English summary (p. 50).

Apart from the infancy period there exist no convincingly proven changes in the number of leukocytes and in the differential distribution of various groups of leukocytes. The osmotic resistance of leukocytes increases markedly in old age (60 to 89 year age group), due either to a change in cell formation or to the decreased cell degradation by the involution of the entire reticulohistiocytary system. The degree of nucleus segmentation of the neutrophilic granulocytes increases in old age. The number of nucleus appendages (drumstick, small club, racket, sessile nodule, minor lobe) does not betray any correlation with the degree of nucleus segmentation and any dependence on age. Since the over-segmentation of the nucleus of neutrophilic granulocytes is only temporarily restored after a single administration of a high dose of vitamin B_{12} (which also causes an increase of the number of leukocytes with rod-shaped nuclei), the change in the nucleus is not explained by the deficiency of vitamin B_{12} in old people, but is considered to depend on the aging process. (Authors' summary, modified)

1853
Cohn, J. E.,
and H. D. Donoso
MECHANICAL PROPERTIES OF LUNG IN NORMAL MEN OVER 60 YEARS OLD.—Jour. Clinical Investigation, 42 (9): 1406-1410. Sept. 1963.

Mechanical properties of lungs in normal men over 60 years old were compared to normal men under 40. Dynamic lung compliance was significantly greater in the older subjects. Transpulmonary pressures at full lung inflation were greater in the younger group. Airway resistance was higher and conductance/volume ratios were lower in the older men. Changes of pulmonary physiological parameters with age in men may be secondary to increased pulmonary compliance in the elderly. (Authors' summary) (29 references)

1854
Dill, D. B.,
and C. F. Consolazio
RESPONSES TO EXERCISE AS RELATED TO AGE AND ENVIRONMENTAL TEMPERATURE. —— Jour. Applied Physiol., 17 (4): 645-648. July 1962.

The responses of two subjects to exercise were studied after a time lapse of 29 years. Environmental temperatures varied from 0 to 50° C. and oxygen consumptions from the resting value to about ten times basal metabolic rate. In the 70 year old subject, the heart rates were about the same in easy and moderate work at temperatures up to 40° C. but much higher at 50° C. In the 50 year old subject, at all work levels the heart rates were the same up to 20° C., lower at 30 and 40° C., and higher at 50° C. The aerobic capacity of both subjects had declined about one-fourth. Thus the responses to the stress of extreme heat showed little loss, whereas there was considerable loss in the ability to withstand the stress of hard work. (Authors' abstract)

1855
Erez, V. P.
[THE EFFECT OF PHYSICAL EXERCISE OF VARIOUS INTENSITY ON THE HYPOPHYSEAL-ADRENOCORTICAL SYSTEM IN YOUNG AND AGED INDIVIDUALS] Vliianie fizicheskoi nagruzki razlichnoi intensivnosti na sistemu gipofiz-kora nadpochechnikov u lits molodogo i pozhilogo vozrasta.—Problemy endokrinologii i gormonoterapii (Moskva), 9 (3): 68-72. 1963. In Russian, with English summary (p. 72).

The excretion of bound 17-oxycorticosteroids (17-OCS) was determined in 56 men and 36 women, ages ranging from 54 to 75 years, and in 12 healthy men, aged 19-23 years. 17-OCS excretion was reduced with advancing age. Physical exercises on an ergometer of high and moderate intensity always increased the 17-OCS excretion. In some untrained individuals of both age groups the increase in 17-OCS excretion was followed by a decrease of 17-OCS excretion below the initial levels. The functional test for adrenal cortex function – ACTH injection administered to the elderly individuals prior to physical training and after six months of training – demonstrated increased capacity of the adrenal cortex after physical training.

1856
Frol'kis, V. V.,
S. F. Golovchenko, S. M. Dukhovichnyi, I. V. Muravov, and S. A. Tanin
[ON THE CHANGES IN WORK CAPACITY, ENERGY EXPENDITURE, BLOOD CIRCULATION, AND RESPIRATION IN AGING] Ob izmenenii rabotosposobnosti, energeticheskikh trat, krovoobrashcheniia i dykhaniia pri starenii organizma.—Vrachebnoe delo (Kiev), 1963 (3): 54-59. March 1963. In Russian, with English summary (p. 59).

A total of 340 subjects 60 to 80 years old, and 110 subjects 18 to 30 years old were studied with respect to differences in the physiology of energy metabolism. On physical exertion the aged group revealed the existence of an inhibitory mechanism which retarded the onset of deep muscular fatigue. The oxygen consumption was at a maximum one minute after the start of exertion, and the oxygen consumption ratio before and after work was 0.6 ± 0.09, while in the younger group it was 1.1 ± 0.15. The systolic arterial pressure after exercises rose by $13.2 \pm 2.7\%$, the diastolic pressure fell by $10.1 \pm 1.1\%$, the pulse pressure difference rose by $19.2 \pm 5.8\%$, and the heart rate increased by $14.5 \pm 2.1\%$. The electroencephalogram in the temporal and occipital leads showed a prolonged depression of α-waves as compared with the younger group.

1857
Godby, R. O.,
S. B. Browning, D. S. Belski, and E. R. Taylor
ANTHROPOMETRIC MEASUREMENTS OF HUMAN SLED SUBJECTS.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico (Project no. 7850). Technical Documentary Report no. ARL-TDR-63-13, April 1963. v+15 p.

Fifty-seven human volunteers are used at present in the study of abrupt acceleration at the Biodynamics Branch of the 6571st Aeromedical Research Laboratory, Holloman Air Force Base, New Mexico. Various standard anthropometric measurements have been made on these subjects. These data and their analyses are presented. Somatotyping of the subjects, performed elsewhere, is presented. (Authors' abstract)

1858
Gubser, A.,
L. Pircher, and H. A. Amsler
[NORMAL VALUES OF BLOOD PRESSURE AND PULSE RATE IN SEVERAL AGE GROUPS AT REST, IN THE ORTHOSTATIC STATE, AND UNDER LIGHT PHYSICAL STRESS] Normalwerte von Blutdruck und Pulsfrequenz verschiedener Altersklassen in Ruhe, Orthostase, und leichter Belastung.—Schweizerische Zeitschrift für Sportmedizin (Genève), 11 (1): 17-31. 1963. In German, with English summary (p. 23).

Heart rate and blood pressure in the standing position and after exercise were examined by Schellong's method as modified by Wiesinger in 150 healthy male subjects divided into three age groups (17-year olds, 20-year olds, and 25-35 year olds). The range of normal values was determined, and the normal values for the different age-groups were compared. Specific criteria for normal circulatory response are demonstrated. The seventeen-year olds as a group were found to differ significantly from the two older groups with respect to nervous regulation of the cardiovascular system.

1859
Halaby, N. E.
FAA DEVELOPS UNIQUE STUDIES TO DETERMINE "TRUE AGE". —— Air Line Pilot, 31 (2): 4-7. Feb. 1962.

A medical research program especially designed to study man's aging process and to develop individual standards based on each pilot's physical condition is being pioneered by the Federal Aviation Agency. Studies are under way in six major work area sections: behavioral sciences, pulmonary functions, cardiovascular, neurological, visual and auditory, and biophysics and electronics. In addition to providing a variety of instrumentation and supporting gear for the study, more specialized electronic equipment for the precise measurements and extensive data processing involved is being developed. The end result will mean greater air safety and elimination of individual inequities from the pilots' retirement rule.

1860
Jaspers, G.
ASYMPTOMATIC CORONARY INEFFICIENCY PATTERN IN PILOTS WITH AN AGING HEART.—Aeromedica acta (Soesterberg, The Netherlands), 8: 25-36. 1961-1962. In English.

A routine periodical aeromedical examination uncovered in a healthy, 50-year old pilot an effort electrocardiogram with a pathological coronary insufficiency pattern in the presence of a normal resting electrocardiogram, normal clinical findings, and no physical complaints. Special cardiac consultation showed that the ECG changes under effort were transient and reproducible. In this case, the changes were of organic origin, assumed to be in accordance with the conception of the "physiologically aging heart" by Claude S. Beck, since they were observed in a healthy older pilot with an aging but not yet pathological heart. The pilot after initial evaluation was returned to flight duty in the presence of a copilot. A follow-up study a year later presented essentially the same picture.

1861
McConville, J. T.,
and M. Alexander
ANTHROPOMETRIC DATA IN THREE-DIMENSIONAL FORM: DEVELOPMENT AND FABRICATION OF USAF HEIGHT-WEIGHT MANIKINS.—Antioch College, Yellow Springs, Ohio (Contract AF 33(657)-9201); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718408). Technical Documentary Report no. AMRL-TDR-63-55, June 1963. v+114 p.

This report describes the development of data and the sculpturing of manikins for use in designing Air Force protective garments and associated personal equipment, as part of a long-range program to present designers of protective flight equipment with a variety of anthropometric data in three-dimensional form. In part, the data are based on a re-analysis of the body statistics reported in WADC Technical Report 56-365, A Height-Weight Sizing System for Flying Clothing, with certain changes in the statistical rationale required by either functional or technical factors. The choice and application of the statistical data used are discussed in detail. Information is also given concerning the sculpturing techniques used in the fabrication of the body forms. Supplementary anthropometric statistics describing the human body in a seated position are presented. The statistics are analyzed in accordance with the Eight-Size Height-Weight sizing system. (Authors' abstract)

1862
Neves Pinto, R. M.
[SEX AND ACOUSTIC TRAUMA: AUDIOLOGIC STUDY OF 199 BRAZILIAN AIRLINE STEWARDS AND STEWARDESSES (VARIG)] Sexo e trauma sonoro: estudo audiólogico de 199 comissários e comissárias da viação aérea Rio Grandense (Varig).—Revista brasileira de medicina (Rio de Janeiro), 19 (6): 326-327. June 1962. In Portuguese, with English summary and conclusions (p. 327).

A comparative audiological study of 199 Varig airline stewards and stewardesses revealed a sex difference in the percentage of acoustic trauma encountered and in the medium hearing threshold levels obtained. Acoustic trauma was found in 23.4% of the stewards and no case was found among the flight stewardesses. Medium hearing threshold levels were better in women also, at least in the 3000, 4000, and 6000 c.p.s. range.

1863
Puister, G. J.,
and J. Modderaar
DIFFERENCE IN EEG PATTERN DISTRIBUTION BETWEEN PILOTS AND FLIGHT ENGINEERS.—Aeromedica acta (Soesterberg, The Netherlands), 8: 79-81. 1961-1962. In English.

Correlation between the EEG pattern and the psychological profile was investigated in a large group of candidate pilots. Slightly more immature candidate pilots were found in the group with class-II EEG pattern (polyrhythmic EEG), than in the group with class-I EEG pattern (clear alpha pattern) or in the group with class-III EEG pattern (flat low voltage fast pattern without a manifest alpha activity). All candidates with a class-III EEG pattern and a good score on the psychological test were found to fail on the flight simulator tests and practical flight experience. Further analysis disclosed that the high psychological test score in this case was due to a high score on the mechanical comprehension tests. A factor analysis carried out also suggested a relation between the EEG pattern and mechanical comprehension score. For further exploration of this relationship 350 EEG's of flight engineers were analyzed and compared with licensed pilots, student pilots and candidate student pilots. The findings confirmed the relationship. Flight engineers with an EEG in class III were rated above average, while those with EEG's in class II were rated slightly below average. The latter is thought to be due to an immaturity factor associated with the polyrhythmic pattern which overshadows the good mechanical ability. In summary, the use of EEG in selection of aircrew members is justified. The finding of a flat or polyrhythmic EEG is considered to be a liability for a pilot. A flat EEG without alpha activity may be considered to be an asset for flight engineers.

1864
Rajalakshmi, R.,
and M. A. Jeeves
CHANGES IN TACHISTOSCOPIC FORM PERCEPTION AS A FUNCTION OF AGE AND INTELLECTUAL STATUS.—Jour. Gerontology, 18 (3): 275-278. July 1963.

Perceptual speed as measured by tachistoscopic form discrimination was studied in a total of 163 subjects ranging in age from 5 1/2 to 74 years. The task required the identification of the odd figure in a set of five stimulus figures presented for a brief duration through the tachistoscope. It was ascertained that performance of the task was not significantly affected by factors such as sensory acuity, speed of eye movements, immediate memory, and attention to detail. Perceptual speed improved up to maturity and declined thereafter. The question is discussed of whether the kind of neuronal changes implicated when applying information theory concepts to account for the decline in perceptual efficiency with age after maturity can also explain the improvement during childhood. It is suggested that the fundamental consideration underlying changes in neuronal count is the resultant number of available and functionally distinct cells. (Authors' summary, modified)

1865
Rennie, D. W.,
B. G. Covino, B. J. Howell, S. H. Song, B. S. Kong, and S. K. Hong
PHYSICAL INSULATION OF KOREAN DIVING WOMEN.—Univ of Buffalo School of Medicine, New York; and Yonsei Univ. School of Medicine, Seoul, Korea (Contract AF 41(657)-302); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8237-39). Technical Documentary Report no. AAL-TDR-62-22, July 1962. iii+19 p.

Human cold adaptation was studied by comparing maximal body insulations (I values) of Korean diving women, non-diving women and men, and of American men and women. The diving women had significantly larger I values than Korean men, due to thicker subcutaneous fat. There was no difference in I value or subcutaneous fat thickness between the diving women and the non-diving women. The Koreans had 30% higher I values than Americans of comparable subcutaneous fat thickness, signifying greater vasoconstriction and a thicker shell of non-perfused tissue. The "critical water temperature" at which shivering occured was 30° C. or lower for the diving women. For other subjects of comparable fat thickness it was 31° to 34° C. This elevated shivering threshold of the diving women was the only evidence of acquired cold adaptation. The thicker subcutaneous fat of women offers more protection to cold and may be the reason why women and not men engage in diving. (Authors' abstract)

1866
Rossen, R.,
E. Simonson, J. Baker, and J. Eiken
PATTERNS OF THE ELECTROENCEPHALOGRAM DURING TILT, HYPOXIA, AND HYPERCAPNIA: RESPONSE CHARACTERISTICS FOR NORMAL AGING SUBJECTS [Abstract]. —— Neurology, 13 (4): 362. April 1963.

The electroencephalographic pattern of 64 normal aging and 45 younger men (mean ages, 59.8 and 24.4 years) were compared when exposed to tilt (65° head up and 15° head down), hypoxia (10% O_2), and hypercapnia (6% CO_2). Each gas mixture was administered in separate experiments for 10-12 minutes along with periodic sampling of blood and alveolar oxygen or carbon dioxide, simultaneous recordings of the extracerebral circulation, electrocardiogram, and other. Results suggest that hypoxia produced more definite electroencephalographic changes than hypercapnia or tilt. Ten of 33 younger and 2 of 20 older men showed electroencephalographic changes with hypoxia; 12 of 45 younger and 15 of 64 older men with hypercapnia; and 18 of 54 older men with tilt. (From the authors' abstract)

1867
Santschi, W. R.,
J. DuBois, and C. Omoto
MOMENTS OF INERTIA AND CENTERS OF GRAVITY OF THE LIVING HUMAN BODY.—North American Aviation, Inc., Los Angeles, Calif. (Contract AF 33(657)-7848); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718408). Technical Documentary Report no. AMRL-TDR-63-36, May 1963. v+62 p.

A study was conducted to determine the moments of inertia and centers of gravity of a sample of 66 living male subjects representative of the Air Force population in stature and weight. Eight body positions were investigated: Standing; Standing, Arms Over Head; Spread Eagle; Sitting; Sitting, Forearms Down; Sitting, Thighs Elevated; Mercury Configuration; Relaxed (Weightless). The procedure was based upon the compound pendulum having a theoretical accuracy of approximately ±2 to ±8 per cent depending upon position and axis. Orthogonal axes, defined as the intersections of the sagittal, frontal, and transverse planes through the standing body, were designated as X, Y, and Z. A set of 50 anthropometric dimensions was taken on each subject, as well as photographs of each subject in each position. Results of the study show that the average moment of inertia varied in this sample from 11 lb. in sec.^{2} about the Z axis to 152 lb. in sec.^{2} about the X axis. Linear regression analysis of moments of inertia vs. stature and weight yielded correlation coefficients ranging between 0.77 and 0.98. (Authors' abstract)

1868
Shock, N. W.,
D. M. Watkin, M. J. Yiengst, A. H. Norris, G. W. Gaffney, R. I. Gregerman, and J. A. Falzone
AGE DIFFERENCES IN THE WATER CONTENT OF THE BODY AS RELATED TO BASAL OXYGEN CONSUMPTION IN MALES. —— Jour. Gerontol., 18 (1): 1-8. Jan. 1963.

Estimates of thiocyanate space and total body water were made in 193 normal males between the ages of 20 and 95 years by the dilution technique, using a single intravenous injection containing sodium thiocyanate and antipyrine. The extracellular space (mean values for all decades, 11.0-11.5 liters) did not change with increasing age. However, the total body water, as measured by antipyrine space, diminished significantly with increasing age (38.4 liters at age 30-39 to 30.9 liters at 90-99 years). Intracellular water, calculated as the difference between total body water and extracellular space, also showed a significant age regression. The reduction in total body water and intracellular water in the absence of change in extracellular water was interpreted as a reflection of the loss of functioning cells with increasing age. Basal oxygen consumption per unit of total water or intracellular water did not show a significant regression on age. It is concluded that the oxygen uptake of functioning cells in old individuals is not significantly different from that in young subjects. (From the authors' summary)

1869
Simon, J. R.,
and J. D. Wolf
CHOICE REACTION TIME AS A FUNCTION OF ANGULAR STIMULUS-RESPONSE CORRESPONDENCE AND AGE.—Ergonomics (London), 6 (1): 99-105. Jan. 1963.

This study was concerned with the effect of varying the angular orientation of a display on the choice reaction times of two age groups; a younger group ranging in age from 20 to 30 and an older group aged from 65 to 86. Two stimulus lights mounted on a vertical circular panel were rotated counterclockwise so that the lights formed angles of 0°, 45°, 90°, 135°, and 180° with the horizontal. Changing the spatial relationship of the stimulus lights relative to the fixed position of two response keys increased the complexity of the task and provided a means for testing the hypothesis that age differences in reaction time increase with increasing task difficulty. Results indicated significant differences in reaction time as a function of both display angle and age. With the least compatible display (180°), reaction time was slowed 30%. The role of spatial cues in the process of translating display information into control action is discussed. The predicted interaction of task difficulty and age was not significant. (Authors' summary)

1870
Trites, D. K.,
and B. B. Cobb
CHRONOLOGICAL AGE, PERFORMANCE POTENTIAL, AND AIR TRAFFIC CONTROLLERS.—Revue de médecine aéronautique (Paris), 1 (3): 27-29. March-April 1962. In English.

Based on studies of two samples of air traffic controller trainees, it was found that chronological age was inversely related to training school and job performance. Psychological tests were of great value in the selection of air traffic controller trainees. It is recommended that a maximum age limit and minimum aptitude levels be established for candidates seeking entry into air traffic controller training. Included are five graphs.

1871
Wise, M. E.
A STATISTICAL ANALYSIS OF HUMAN HEARING THRESHOLDS IN A VERY LARGE POPULATION. —Acustica (Stuttgart), 13 (3): 146-154. 1963.

Lower limits of audibility for pure tones were determined for 550,000 people at the World Fairs at New York and San Francisco in 1939 and 1940. From a sample of 35,589 of the people tested, Steinberg, Montgomery, and Gardner obtained distributions of hearing thresholds classified by sex, ten-year age groups (from 10 to 20, 20 to 30, 30 to 40, 40 to 50, and over 50) and sound frequencies of 440, 880, 1760, 3520, and 7040 c.p.s. Their results are used to transform the decibel scale of threshold into one that as far as possible normalizes (renders Gaussian) most of these distributions. Some surprising regularities revealed by this attempt are discussed. In 50 distributions of thresholds transformed in this way the percentiles and standard deviations also revealed a fairly simple pattern of variation with age and sound frequency. (Author's summary)

8. MEDICAL PROBLEMS AND PHARMACOLOGY

[Medical personnel under 7]

a. General

1872
Benesh, L. C.
OCCUPATIONAL MEDICINE IN THE AVIATION INDUSTRY. —— Jour. Occupational Med., 4 (7): 370-372. July 1962.

The medical and hygienic program for the Cape Canaveral Missile Base emphasizes pre-employment, routine daily and periodic physical examination of all personnel, and highly specialized examinations for many types of employment. Included is a classification of employee surveillance examinations according to employee groups, type of examination, and doctors' participation. Constantly changing activities on the base necessitate lability in the protective and safety program. The training of disaster teams and of all employees in first aid is stressed.

1873
LaRoche, L. P.
OCCUPATIONAL MEDICINE AT A MISSILE TEST BASE. —— Indus. Med. and Surg. 31 (3): 110-114. March 1962.

Industrial medicine in the aviation industry is basically little different from that in any industry. One type of work which sets it aside from other industries is the selection, training, and maintenance of the flight personnel. We have specialists in the field of aviation medicine to take care of the problems unique to this area. Other types of jobs not exclusive to aviation but more common and extensive in this industry are ramp service work, with its many variations and exposures and the mechanical work on a highly complex and intricate mechanical device–the airplane. These factors present certain problems in selection of workers for these kinds of work and the proper maintenance of such employees' abilities to handle the work safely and efficiently. (Author's summary)

1874
Lomonaco, T.
[MEDICAL SERVICE IN PERIPHERAL AERONAUTICAL AREAS, WHAT IT IS AND WHAT IT SHOULD BE] Il servizio sanitario negli enti periferici aeronautici qual'è e quale dovrebbe essere.— Rivista aeronautica (Roma), 39 (4): 515-528. April 1963. In Italian.

The following medical services are provided by airports: (1) supervision of individual and collective hygiene, and institution of methods for the prevention of occupational disorders; (2) treatment and care of ambulatory patients; (3) first aid centers for persons with aircraft injuries, etc.; (4) medicolegal service; and (5) psychophysical aid to pilots. This latter service utilizes specialists in aviation and space medicine and is found not only at airports, but at air bases, etc. It provides for the treatment of aeromedical diseases of flying personnel, first aid to personnel involved in flight accidents, and for other urgent causes of a medical and surgical nature, periodic medical examination of personnel for control purposes, and aerophysiological training of flight personnel in conventional and space flight (i.e., adjustment to hazards of high altitude, hypoxia, accelerations, temperature changes, weightlessness, isolation, etc.).

1875
Musgrave, P. W.
PHYSIOLOGIC PROBLEMS OF IMPORTANCE TO CIVILIAN PILOTS.—Texas State Jour. Med., 59 (3): 192-195. March 1963.

Civilian physicians associated with aviation should be knowledgeable in several general areas of aviation medicine in order to educate and advise their patients who fly. Chiefly, they should be familiar with the fundamentals concerned with (1) altitude physiology, (2) effects of gravity and motion, (3) visual criteria in aviation, (4) instrument flying, (5) diseases and flying, and (6) drugs, nutrition, and alcohol in flying. This information will aid in saving lives and lowering the percentage of pilot factor accidents.

1876
Reighard, H. L.
MEDICAL SERVICES AT AIRPORTS. —— Arch. Environmental Health, 5 (4): 344-357. Oct. 1962.

A study of the need for comprehensive medical programs at large airports was made, based on employer interviews. No employer provided health services for employees as an integrated occupational health program. Emergency medical care was obtained from either an emergency room or from a doctor in a nearby section of the city. All employers maintained some form of safety program for the review of occupational hazards and education of employees in accident prevention. Recommendations made for the improvement of medical facilities at airports suggest they provide comprehensive programs of occupational medicine, be used as a training site for civilian physicians pursuing a career in aviation medicine, and provide the medical component of crash rescue plans and operations. Included are appendixes outlining the needs for medical service at airports and the basic sources for the present study.

1877
Vastine, R. J.
CIVILIAN AVIATION MEDICINE.—GP, 27 (5): 116-122. May 1963.

Periodic medical examinations are required for pilots, but their frequency varies with the class of license. First class airmen (airline transport pilots) require examination every six months, second class (commercial pilots, navigators, engineers) every twelve months, and third class (private, student, balloon pilots, flight radio operators) every twenty-four months. Specific aviation regulations govern certification, and disqualification is related to coronary artery disease, diabetes requiring the use of hypoglycemic agents, and disturbances of behavior, character, or consciousness.

Exemptions from the regulations can sometimes be sought. The physician can devise a medical program for the flight operations of a small business. This includes regular medical and safety examinations, toxicological studies, food inspection, and training and retraining programs. Transportation of the sick and accident investigation is also under the physician's supervision. Included is a table listing conditions contraindicated for flight (heart, pulmonary, psychotic, contagious diseases, etc.), and a table outlining the rules to be followed before a trip is undertaken in an ambulance plane.

1878
Vickers, A.
THE ROYAL FLYING DOCTOR SERVICE OF AUSTRALIA.—World Med. Jour., 10 (3): 171-172. May 1963.

A brief history is given of the Royal Flying Doctor Service of Australia, a public philantropic medical organization which originated about 1912. At present there are 14 bases, each having a flight doctor and a well-equipped hospital. Preliminary preparation for surgery can be done in flight when patients are being brought to the hospital. The various services of this group as well as records of flight time and the number of patients treated are given.

1879
White, M. S.
AEROSPACE MEDICINE IN CLINICAL PRACTICE. —Georgetown Med. Bull., 17 (1): 5-12. Aug. 1963.

The basic fundamentals of flight physiology concerned with the effects of changes in barometric pressure, atmospheric gases, temperature, and gravity on flying personnel and the problems associated with aviation noise, radiations, glare, and toxic chemicals are discussed in relation to clinical practice. Common clinical complaints in flying are headache and fatigue usually related to mild hypoxia, and aerotitis and aerosinusitis caused by barometric pressure changes. The clinician's awareness is stressed of the hazards of flight for patients with cardiovascular and certain pulmonary diseases, anemia, malaria, tuberculosis, and patients having undergone recent abdominal and ocular surgery.

b. Sicknesses

1880
Beckh, H. J. von
A SUMMARY OF MOTION SICKNESS EXPERIENCES IN WEIGHTLESS FLIGHTS CONDUCTED BY THE AEROMEDICAL FIELD LABORATORY.—In: Symposium on motion sickness with special reference to weightlessness, p. 67-72. Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-63-25, June 1963.

Data describing the incidence of motion sickness during 51 weightless missions divided into two series are presented. The 18 subjects included experienced jet pilots, 2 persons who had never flown previously, and 14 others of intermediate flying background as pilots or crewmembers. Subjects 1-9 volunteered for the first series as did subjects 8-18 for the second series. Only subjects 8 and 9 participated in both series. In the first series only 3 of the 9 subjects (1, 4, 7) suffered motion sickness of different degrees. In the second series 4 of the 11 subjects (9, 10, 13, 18) suffered motion sickness. Subject 9 suffered motion sickness in the second series but not in the first. A table indicates whether motion sickness occurred during pre-weightlessness acceleration or post-weightlessness acceleration. The severity of the motion-sickness symptoms (nausea, emesis, severe emesis) is also described. These data and those from weightless experiments in the cargo aircraft C-131 are compared and discussed.

1881
Chinn, H. I.
WHAT IS MOTION SICKNESS?—In: Symposium on motion sickness with special reference to weightlessness, p. 23-25. Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-63-25, June 1963.

Investigations of the symptomatology and incidence of motion sickness are summarized. Although many symptoms of motion sickness have been studied, it is suggested that the best criterion of the malady is the onset of vomiting and the best subject is man. As to the incidence of motion sickness, man and the dog seem to be the most susceptible animals. The incidence of motion sickness obtained in studies on the sea, in the air, and on synthetic devices such as the swing are given. Weightless maneuvers may provide a new tool for studying the basic factors causing motion sickness.

1882
Coburn, K. R.
DECOMPRESSION SICKNESS: PRESENT STATUS. —Jour. Royal Naval Med. Service (London), 48 (2): 69-75. 1962.

In spite of the vast amount of research done on the problem of decompression sickness, the precise mechanism of bubble formation and pain production, as in bends, is still in question. The symptoms of decompression sickness are varied, and appear to be dependent upon bubble location. These symptoms are: skin manifestations, bends, bone changes, chokes, staggers, and decompression collapse syndrome (rarely observed but representing a grave condition). Age and exercise at altitude are known to increase the susceptibility to decompression sickness, especially to bends. Included are many representative tables and figures.

1883
Gerathewohl, S. J.
PERSONAL EXPERIENCES DURING SHORT PERIODS OF WEIGHTLESSNESS IN JET AIRCRAFT AND ON THE SUBGRAVITY TOWER.—In: Symposium on motion sickness with special reference to weightlessness, p. 73-80. Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Lab.,(6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no.

718405). Technical Documentary Report no. AMRL-TDR-63-25, June 1963.

The motion sickness symptoms associated with weightlessness may be caused by the following factors and their interactions: (1) a very low threshold to motion sensitivity in certain individuals, particularly during rapid and repeated changes of acceleration; (2) a (perhaps pathologically) low threshold for a permanent change of gravireceptoric input (this may prevent the adaptation to a permanent state of weightlessness anticipated in orbital or space flights); (3) a stimulation of the semicircular canals during the weightless state elicited by involuntary movements (Coriolis effects); (4) psychological and emotional factors; or (5) physiological factors associated with jet flights. A close correlation seems to exist between the proneness to "common motion sickness" and the autonomic disturbances observed in the author's experiments. The extent to which the weightless state alone influences the sickness incidents will remain in doubt until manned rocket flights are accomplished. (From the author's conclusions) (38 references)

1884
Graybiel, A.,
and W. H. Johnson
A COMPARISON OF THE SYMPTOMATOLOGY EXPERIENCED BY HEALTHY PERSONS AND SUBJECTS WITH LOSS OF LABYRINTHINE FUNCTION WHEN EXPOSED TO UNUSUAL PATTERNS OF CENTRIPETAL FORCE IN A COUNTER-ROTATING ROOM.—Ann. Otol. Rhinol, & Laryngol., 72 (2): 357-373. June 1963.

Normal subjects and subjects with bilateral labyrinthine defects (L-D) were exposed to unusual patterns of centripetal force in an attempt to evoke symptoms of motion sickness. In the normal subjects both the otolithic and nonotolithic gravireceptors were stimulated, in the L-D subjects only the nonotolithic gravireceptors. Two series of experiments were conducted on different occasions using a counter-rotating room (CRR). Experimental variables included the inertial force, whether the head was fixed or moving, and whether the eyes were covered or the room viewed with or without spectacles with prisms of 15°. With head fixed and eyes closed, all subjects perceived the changing direction of resultant force with respect to themselves as an illusion of rotation and the direction of resultant force as a tilt from the vertical with respect to the earth or floor of the room. With room lighted it appeared to be tilted, the oculogravic illusion, and in this regard there may have been differences between the normal and L-D subjects. Some of the normal but none of the L-D subjects experienced symptoms of motion sickness. This group difference was probably attributable to auricular sensory organs caused by precipitating and predisposing factors. The precepitating agent, centripetal force, was adequate in the absence of stimulation of the canals. This ruled out intervestibular conflict as a cause of the symptoms except insofar as the canals contributed to the normal integrative patterns in the central nervous system, which were disturbed by the unusual sensory inputs. Predisposing factors accounted for great interindividual variance in susceptibility. (Authors' abstract, modified)

1885
Harris, J. G.
RORSCHACH AND MMPI RESPONSES IN SEVERE AIRSICKNESS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-5001, Subtask 1). Report no. 22, Jan. 25, 1963. ii+13 p.

Conventional analyses of data obtained on the Rorschach Test administered on an individual basis to two groups of severely airsick naval aviation cadets and one group of nonairsick cadets yielded no replicable differences between groups, but careful analysis of content yielded statistically significant differences when any one or more of five items of content was present in an individual record. A limited cross-validational procedure, involving a comparison of each of the three original groups with an unselected group of entering cadets to whom the Group Rorschach had been administered, confirmed the previous findings. Differences on Minnesota Multiphasic Personality Inventory profiles between a group of 25 airsick and 25 nonairsick subjects were statistically nonsignificant on all variables. The findings are discussed with reference to current psychoanalytic and physiological interpretations of motion sickness. The investigator concludes that there is suggestive evidence for greater disturbance in personality functioning among subjects in the airsick groups in the form of possible fear of loss of control over aggressive impulses. (Author's abstract)

1886
Johnson, W. H.
ETIOLOGY OF MOTION SICKNESS (THE SIGNIFICANCE OF MOTION IN MOTION SICKNESS).—In: Symposiun on motion sickness with special reference to weightlessness, p. 27-31. Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-63-25, June 1963.

A critical review of the present status of our knowledge on the etiology of motion sickness is presented. Conflicting opinions as to the types of motion responsible and consequently the relative importance of the separate vestibular receptors are discussed. Conclusions are reached as to the application of this knowledge to parabolic flight used to produce weightlessness and the significance of some vestibular reactions in space travel is pointed out. (Author's summary)

1887
Kennedy, R. S.,
and A. Graybiel
THE VALIDITY OF TESTS OF CANAL SICKNESS IN PREDICTING SUSCEPTIBILITY TO AIRSICKNESS AND SEASICKNESS. —— Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1, Report no. 71); and National Aeronautics and Space Administration, Washington, D. C. (NASA Order no. R-47). June 27, 1962. ii+8 p.

Twenty-one subjects were exposed to a laboratory method for producing motion sickness (canal sickness) aboard the Slow Rotation Room. In an effort to determine the predictive ability of this method the subjects were also subjected to acrobatics in an aircraft and to heavy or moderately calm sea states. In addition, nystagmic response to caloric stimulation was observed. It was found that a positive relationship existed between performance on the Slow Rotation Room, caloric irrigation, and airsickness. This relationship also existed during heavy seas and to a lesser extent on moderate seas. In general, it may be concluded that individual performance on the standard procedure used to produce canal sickness aboard the Slow Rotation Room is predictive of susceptibility to air and seasickness. (Authors' abstract)

1888
Komendantov, G. L.,
and V. I. Kopanev
[MOTION SICKNESS AS A PROBLEM OF SPACE MEDICINE] Ukachivanie kak problema kosmicheskoi meditsiny.—Problemy kosmicheskoi biologii (Moskva), 2: 84-92. 1962. In Russian, with English summary (p. 92).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 84-99. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

Vestibular-vegetative disturbances observed in G. S. Titov during his space flight in Vostok 2 under weightless conditions are interpreted as the space version of sea-sickness. Possible physiological mechanisms of space sickness (disturbances in the coordinated functioning of various analyzers, effects of Coriolis accelerations, weakening of reciprocal influences from the otolith apparatus upon the function of the semicircular canals, conditioned-reflex influences) are discussed. Prophylaxis is discussed in terms of selection, training, creation of optimal conditions within the spaceship cabin, drugs, and technical perfection of the spaceship. (77 references)

1889
Lansberg, M. P.
CANAL-SICKNESS: FACT OR FICTION?—Revue de médecine aéronautique (Paris), 1 (2): 173-178. Dec. 1961-Jan. 1962. In English.

Also published in: Indus. Med. and Surg., 32 (1): 21-24. Jan. 1963.

An analysis of linear and angular velocities and accelerations encountered in airplane and space flight shows that from a mechanical viewpoint there are large differences between the different situations likely to produce motion sickness. In no situation were stimuli found that could be considered traumtic for the sense organ. However, a conflict was always demonstrable between signals reaching the brain centers from the different parts of one sense organ, i.e., the semicircular canals and the otoliths. Experiments in a slow rotation room furnished new data for consideration in the construction of rotating spaceships. Labeling the symptoms experienced by the test persons as "canal sickness" was not warranted, since they did not result from stimulation of the semicircular canals but from the intralabyrinthine conflict which embarrased the coordinating brain centers. Disembarking from the slow rotation room resulted in renewed difficulties when head movements were executed. The situation in a rotating room is not identical with that in a rotating space ship.

1890
Loftus, J. P.
MOTION SICKNESS IN THE C-131B.—In: Symposium on motion sickness with special reference to weightlessness, p. 3-5. Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-63-25, June 1963.

Capabilities of the C-131B cargo-type aircraft as a weightlessness or zero-gravity facility are described. Data from two studies using this device are presented, describing motion-sickness symptoms reported. These data include the relationship (1) prior motion sickness to experience on weightlessness flights, (2) prior flight experience to motion sickness experience on weightlessness flights, and (3) motion sickness experience on weightlessness flights in relation to willingness to participate in further flights. This information is a fallout from engineering tests and psychophysical studies that were the purpose of the flights. Such flights may be a useful place to study some aspects of motion sickness and may yield information with regard to hazards in weightlessness.

1891
Niess, O. K.,
and R. B. Stonehill
DYSBARISM: A JET AGE PROBLEM OF ALL PHYSICIANS.—Diseases of the Chest, 44 (2): 121-125. Aug. 1963.

With increased utilization of commercial jet aircraft, the possibility of loss of cabin pressurization and subsequent high altitude exposure of the occupants increases. Therefore, it becomes important for physicians to become familiar with the manifestations of altitude dysbarism. The effects of reduced barometric pressure result from gases trapped within the body cavities or the evolution of gases from the liquid phase within the tissues or body fluids. In general, trapped gases can be quite discomforting, but not usually dangerous unless the pressures generated are sufficient to cause rupture of a hollow viscus, and this is quite rare. Reestablishment of a patent foramen between the cavity and the atmosphere will result in relief. However, the problems that arise when nitrogen in the body fluids or fat tissue comes out of solution can be life-threatening. Since this is more apt to occur in older and obese individuals, a significant percentage of the flying public can be considered "dysbarism prone". The manifestations are bends (with extremity pains), chokes (with respiratory distress, substernal pain, and dry cough) and neurocirculatory collapse. When circulatory failure becomes evident, mortality can be expected and intensive care is essential. Since neurocirculatory failure develops rapidly after a relatively symptom-free period, it is advocated that individuals who experience any manifestation of dysbarism be observed for at least two hours after removal from altitude exposure. Treatment is supportive and includes oxygen administration. However, it appears that the early correction of reduced circulating plasma volume is essential. (Authors' summary, modified)

1892
Okunev, R. A.
EXPERIENCE IN THE USE OF HYPNOSIS AND SUGGESTION FOR THE PROPHYLAXIS AND TREATMENT OF SEA-SICKNESS.—Military Medical Journal, 1961 (12): 119. Washington: U.S. Joint Pub. Research Serv., no. 13063 (CSO:1374-N), March 20, 1962. (Available from Office of Technical Services, U. S. Dept. Commerce)

English translation of: Opyt primeneniia gipnoza i vnusheniia dlia profilaktiki i lecheniia ukachivanniia.—Voenno-meditsinkii zhurnal (Moskva), 1961 (12): 72. Dec. 1961. In Russian.

The effectiveness of hypnotic treatment was investigated in regard to prophylaxis and treatment of motion sickness in experimental conditions (rotation in the Bárány chair) and at sea. Hypnosis reduced motion sickness considerably and increased the work capacity of individuals during rocking. The effectiveness of hypnosis is directly related to the depth of trance reached in the sessions. Reinforcement sessions twice a week were found necessary after completion of the course. On the average, the course required 30 sessions for most individuals. Tape-recorded broadcasts aboard the ship were found to be a satisfactory substitute for the hypnotist. Since 20-25% of people cannot be hypnotized satisfactorily, hypnosis for motion sickness should be combined with the administration of anti-motion sickness drugs.

1893
Powell, T. J.,
E. P. Carrigan, and M. J. Stanfield
OBESITY IN AIRCREW. — Canad. Services Med. Jour. (Ottawa), 18 (5): 354-362. May 1962.

It is submitted that obesity and overweight as judged from a "standard" table have little or no relationship. Careful studies indicate no relationship between overweight and dysbarism. Pathologists appear to be somewhat lax in defining the term "obesity" in describing cases of fatal dysbarism. Although the apparent association of fatal dysbarism and obesity has not been proven, weight-reduction programs for the aircrew have been instituted. A possible relationship between alcohol consumption and dysbarism may exist but additional study is needed. It is suggested that pathologists define obesity in terms of adipose organ fat and fatty infiltration of other tissues.

1894
Smith, P. K.
PROPHYLAXIS AND TREATMENT OF MOTION SICKNESS.—In: Symposium on motion sickness with special reference to weightlessness, p. 37-42. Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-63-25, June 1963.

A number of agents, notably hyoscine, promethazine, cyclizine, and meclizine, are significantly and regularly effective in preventing seasickness and airsickness. No one of these agents will prevent motion sickness in all individuals. The side-effects of available agents are sometimes appreciable and may preclude their chronic use. Agents effective in one environment are not always effective in another one. For this reason it is not possible to predict their effectiveness in weightless subjects. (Author's summary) (25 references)

1895
Steele, J. E.
MOTION SICKNESS AND SPATIAL PERCEPTION: A THEORETICAL STUDY.—In: Symposium on motion sickness with special reference to weightlessness, p. 43-65. Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-63-25, June 1963.

The inadequacies of theories of motion sickness which attach too much importance to the intensity of stimulation or to the particular modality stimulated are discussed. Motion sickness is the result of strenuous attempts to solve a difficult information-processing problem. It results from the effort made to solve, not specifically from the failure to solve, which merely motivates further effort if the need persists. The problem is that of maintaining spatial orientation or orientation to and compensation for accelerative forces. This involves the maintenance of an inertial reference frame and the perception of movement relative to it. The problem is made difficult by novel environments which invalidate customary approaches to the integration and interpretation of sensory data and to the programming of muscular movements. (Author's summary) (63 references)

c. Diseases and Injuries

1896
Arias-Stella, J.,
and H. Kruger
PATHOLOGY OF HIGH ALTITUDE PULMONARY EDEMA.—Arch. Pathol., 76 (2): 147-157. Aug. 1963.

The pathologic findings in two fatal cases of high-altitude pulmonary edema are described. The presence of alveolar and bronchiolar zonal edema accompanied by hyaline membranes was the most important lesion. Recent thrombosis of the septal capillaries in both cases and of small and medium-sized pulmonary arteries in one, was another finding. The histochemical study of the hyaline membranes showed a structure similar to that found in the hyaline membrane disease of the newborn and in the placental "fibrinoid". The possible pathogenesis of the pulmonary edema and the significance of the presence of hyaline membranes are discussed. (Authors' summary) (31 references)

1897
Aurucci, A.,
and F. Ermenegildo
[STATISTICAL INCIDENCE OF PLEUROPULMONARY PATHOLOGY REVEALED BY A SCREEN PHOTOGRAPHIC SURVEY OF 8000 MILITARY AVIATION SPECIALIST CANDIDATES: CONSIDERATIONS OF SOME CASES WITH UNCERTAIN MEDICO-LEGAL EVALUATION] Incidenza statistica della patologia pleuropolmonare rilevata alla indagine schermografica in 8000 candidati allievi

specialisti A. M.: considerazioni su alcuni reperti di incerta valutazione medico-legale. — Rivista di medicina aeronautica e spaziale (Roma), 25 (1): 111-120. Jan.-March 1962. In Italian, with English summary (p. 118).

The medico-legal aspects are discussed of pleuropulmonary pathology found in a fluororoentgenographic survey of 8,235 aviation specialist candidates between 17 and 21 years of age from various regions of Italy. Evaluation is made of calcified foci in the lung hilus and parenchema (almost always of tubercular origin), and of the problems involved in differentiating them from pulmonary coccidiomycosis and histoplasmosis. For complete medico-legal evaluation it is necessary to use fluororoentgenography to identify causative processes (primary complex, precocious bacillary spread, post-primary processes) which are different in prognosis and medico-legal importance. Active pleuropulmonary tubercular processes and pleurisy are of minor importance in the medicolegal profile as these diseases prevent enlistment.

1898
Bertoni, R.,
R. Bordes, G. Nicolas, and P. Robert
[TREATMENT OF BAROTRAUMATIC INJURIES OF THE EAR] Traitement des accidents baro-traumatiques de l'oreille.—Revue de médecine aéronautique (Paris), 2 (5): 70-72. Nov.-Dec. 1962. In French.

Treatment of these types of barotrauma of the ear are described: acute (with and without effusion), subacute, and chronic. In the acute type without effusion, it is very important to unblock the eustachian tube as quickly as possible. Acute barotrauma with effusion can be treated by paracentesis with adequate antiseptic precautions. Subacute cases, which are clinically variable, can generally be cured by two or three aerosol series with hyperpressure. The treatments of chronic barotrauma include tubular radiotherapy, aerosol therapy, and micro-surgery of the middle ear as a last resort.

1899
Bordes, L. R.,
P. Robert, and R. Delage
[FRONTAL MUCOCELE REVEALED BY BAROTRAUMA] Mucocèle frontale révélée par barotraumatisme.—Revue de médecine aéronautique (Paris), 2 (8): 446-448. Aug.-Sept. 1963. In French.

A case history is presented of a young pilot candidate in whom barotrauma led to revelation of a latent mucocele in the right frontal sinus.

1900
Bordes, L. R.,
and P. Robert
[TREATMENT OF BAROTRAUMATIC SINUSITIS] Traitement des sinusites baro-traumatiques.—Revue de médecine aéronautique (Paris), 2 (7): 319-323. May-June 1963. In French.

A brief outline is presented of the anatomophysiology of the paranasal sinuses, and of the etiopathogenesis and clinical manifestations of barotraumatic sinusitis. Prevention of barotraumatic accidents is advocated by the medical selection and surveillance of flying personnel using otorhinolaryngological criteria, and by training personnel in maneuvers to follow during flight should any attacks occur. Special consideration is given to medical (cocaine, naphthazoline, antibiotics, menthol), surgical (trepanopuncture of Lemoyne), and etiological treatments. Cure without sequelae may be obtained by these methods and the flying status not changed. If cure is not achieved by surgical treatment, status must be defined by the otorhinolaryngologist.

1901
Bosley, R. J.,
and T. J. Butler
BAROTRAUMATIC CYST OF THE FRONTAL SINUS. — A.M.A. Arch. Otolaryngol., 76 (1): 88-93. July 1962.

Sinus barotrauma and its pathologic physiology are briefly discussed. A case is presented in which barotrauma produced a submucosal hematoma in the frontal sinus of a jet pilot. Typically such hematomata undergo spontaneous resolution in a few months. However, this lesion enlarged to fill the sinus cavity and occlude the nasofrontal duct. Removal was accomplished by means of the osteoplastic frontal sinusotomy approach. (Authors' summary)

1902
Cockett, A. T. K.,
C. C. Beehler, and J. E. Roberts
ASTRONAUTIC UROLITHIASIS: A POTENTIAL HAZARD DURING PROLONGED WEIGHTLESSNESS IN SPACE TRAVEL. — Jour. Urol., 88 (4): 542-544. Oct. 1962.

Astronautic urolithiasis may occur during prolonged space travel because of immobilization and a state of weightlessness. Of the etiological factors for urinary lithiasis reviewed, increased concentration of urinary sediment, coupled with urinary stasis, may be significant in relation to space travel. The emotional stress of space flight may enhance renal lithiasis. Vitamin D in excess may cause increased calcium absorption from the gastrointestinal tract; in space travel, prolonged exposure to sunlight may be a contributing factor to calculus formation. Preventive measures suggested are: a vigorous in-flight program of physical exercises employing spring-loaded devices to maintain normal muscle activity; rotation of space craft to create artificial gravity; limitation of dietary calcium intake; avoiding overexposure to ultraviolet light; drugs to lower urinary pH; adequate oral fluid intake; rigid voiding schedules; and avoiding any indwelling urinary catheter.

1903
Dees, T. M.,
and N. M. Hensler
TUBERCULOSIS IN AIR FORCE PERSONNEL: IS TREATMENT AND RETURN TO ACTIVE DUTY PRACTICAL? — Military Med., 127 (10): 822-826. Oct. 1962.

A follow-up survey of 140 patients treated for tuberculosis revealed that it was more profitable for the Air Force to treat and return to duty properly motivated patients with minimal and moderately advanced tuberculosis. This was based on the finding that 82% of the patients were still on active duty, that of the 21 patients who had been separated only 4 were separated because of problems related to their tuberculosis, and that previous tuberculosis did not seem to affect the individual's work performance. The only significant effect of tuberculosis on the patients' careers seems to be related to length of hospitalization and to either temporary or permanent removal from flying status. Forty-seven percent of those grounded were eventually returned to flying status and two individuals not previously on status were put on status after completion of therapy for pulmonary tuberculosis. The need is stressed for an integrated follow-up system of tuberculosis patients. (Authors' conclusions, modified)

1904
Delahaye, R. P.,
R. Pannier, and L. Tabusse
[BACKACHES IN FLYING PERSONNEL: SIXTY-EIGHT CASE REPORTS OF BACKACHE OBSERVED IN FLYING PERSONNEL. HÔPITAL MILITAIRE D'INSTRUCTION DOMINIQUE LARREY, VERSAILLES] Les lombalgies du personnel navigant: A propos de soixante huit cas de lombalgies observées chez le personnel navigant. Hôpital militaire d'Instruction Dominique Larrey, Versailles.—Revue de médecine aéronautique (Paris), 2 (7): 315-319. May-June 1963. In French, with English summary (p. 318).

Backache occurring in flying personnel was studied and schematically differentiated into three clinical types: (1) post-traumatic backache (28 cases) following crash, bailout, or ejection which appears some time after the accident. Pain is due also to vertebral and disc disorders and manifest after a considerable lapse of time, indicating the need for clinical and X-ray checking of all spinal injuries. (2) Backache due to arthrosis (31 cases) in patients over 40 years of age, overweight, sedentary, and with faulty metabolism due to incorrect eating habits. (3) Backache due to faulty posture in helicopter pilots (9 cases), varying in intensity according to the type of helicopter and nature of missions. Kinesiotherapy and corrective exercises are recommended for these cases. This therapy may produce a great improvement or disappearance of backache making drug treatment (such as corticoids) unecessary.

1905
Delahaye, R. P.,
L. Tabusse, and R. Jolly
[INTRAVENOUS UROGRAPHY IN MILITARY FLIGHT PERSONNEL (STATISTICAL ANALYSIS OF THREE YEARS OF HOSPITAL PRACTICE] L'urographie intraveineuse dans le personnel navigant militaire (étude statistique de trois ans de pratique hospitalière).—Revue de médecine aéronautique (Paris), 2 (8): 441-443. Aug.-Sept. 1963. In French.

From 1960 to 1962, the most common causes for the 146 urographies in navigation personnel were (in order of frequency): recent renal colic, hematuria, pyuria, and albuminuria. Of the 30 cases of lithiasis, over half the number occurred in men over 30 years of age.

1906
Dominy, D. E.,
and D. C. Campbell
SURGICALLY CORRECTABLE ACQUIRED CYSTIC DISEASE OF THE LUNG AS SEEN IN FLYING PERSONNEL.—Diseases of the Chest, 43 (3): 240-244. March 1963.

Pulmonary emphysema is defined and discussed, and cases operated on for recurrent spontaneous pneumothorax with findings of blebs or localized emphysematous changes are presented. Patients are given convalescent leave and pulmonary function studies are made upon their return. Patients evaluated with respect to return to flying are taken on a simulated flight to 43,000 ft. at a rate of 10,000 ft. ascent per minute, with free falls to 30,300 ft., followed by descent to ground level. Then a simulated rapid decompression from 8,000 to 25,000 ft. is produced and repeated x-rays are made. If the tests are normal and no side effects are experienced as a result of the simulated flight, it is recommended that the patient be returned to flying status. The added risks of flying with respect to communicating or noncommunicating emphysematous air spaces are discussed in relation to changes in altitude and the pressure oxygen system.

1907
Fabre, J.
[VERTEBRAL TRAUMATOLOGY OBSERVED IN AVIATION] La traumatologie vertébrale observée en aéronautique.—Revue de médecine aéronautique (Paris), 1 (3): 63-69. March-April 1962. In French.

Vertebral pathology is frequently observed in: (1) pilots of conventional aircraft who crash on a landing strip or on unfamiliar terrain; (2) jet pilots who eject by means of a catapult seat; (3) helicopter personnel; and (4) parachutists. Discussion is presented on the frequency and localization of vertebral fractures in these subjects, their pathogenetic mechanisms, X-ray findings, and preventive measures.

1908
Fred, H. L.,
A. M. Schmidt, T. Bates, and H. H. Hecht
ACUTE PULMONARY EDEMA OF ALTITUDE: CLINICAL AND PHYSIOLOGIC OBSERVATIONS. — Circulation, 25 (6): 929-937. June 1962.

Three separate episodes of acute pulmonary edema are described that developed in two otherwise healthy individuals during heavy exertion at high altitudes. Detailed physical examination and laboratory studies failed to demonstrate pulmonary infection or cardiac disease. Data obtained by cardiac catheterization during one of these episodes revealed elevation of the pulmonary artery pressure and a normal left atrial pressure. This syndrome appears to be the consequence of pulmonary vascular obstruction distal to the capillary bed, presumably in the pulmonary veins. It is brought about by exposure of susceptible individuals to high altitudes, and is completely reversed by oxygen administration. (Authors' summary)

1909
Galban, P.
[STATISTICAL DATA CONCERNING NEPHRITIC COLIC AND RENAL LITHIASIS IN FLYING PERSONNEL OF THE AIR FORCE] Données statistiques

concernant les coliques néphretiques et la lithiase rénale chez les membres de personnel navigant de l'armée de l'air.—Revue de médecine aéronautique (Paris), 2 (8): 437-439. Aug.-Sept. 1963. In French.

Among the 9000 members of the flight personnel examined from 1959 to 1962, 154 had renal colic at some time. Of these patients one-half had urinary lithiasis. Attacks of colic were not seasonal, and were more frequent in older personnel and in those living overseas. Certain occupations, e.g., fighter pilots, were less affected by colic.

1910
Gómez Cabezas, P.
[HYPACUSIA OF THE AVIATOR] Hipoacusias del aviador. — Revista de aeronáutica y astronáutica (Madrid), 12 (261): 687-691. Aug. 1962. In Spanish.

Following an outline of the anatomo-physiological mechanism of hearing, barotrauma in aviators is discussed in terms of its etiology, pathogenesis, symptoms, pathology, and diagnosis. The early detection of barotrauma is stressed in order to avoid hearing damage in aviators.

1911
Gurdjian, E. S.,
H. R. Lissner, and L. M. Patrick
PROTECTION OF THE HEAD AND NECK IN SPORTS. — Jour. Amer. Med. Assoc., 182 (5): 509-512. Nov. 3, 1962.

Existing data on factors at work in athletic injuries to the head and neck are reviewed. Measurements have been made of the energies, accelerations, and changes of intracranial pressure involved in cases of concussion and skull fracture. In the cadaver, linear skull fractures can be produced by energies of 4.6 to 6.9 kg.m. These impart an average acceleration of 112 g and increase the intracranial pressure by about 1,450 mm. Hg. Such figures afford a basis for the construction of protective helmets. The thickness of padding required can be computed from the weight and velocity of the injuring object. If the velocity is doubled, the padding has to be 4 times thicker. (Authors' abstract)

1912
Hirsch, C.,
and A. Nachemsson
CLINICAL OBSERVATIONS ON THE SPINES OF EJECTED PILOTS.—Revue de médecine aéronatique (Paris), 1 (2): 193-194. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (1): 28-29. Jan. 1963.

Othropedic examination of 55 pilots in the Royal Swedish Air Force, who during the years 1957 to 1960 rescued themselves by catapult ejections, revealed that about 30% of the pilots sustained one or several fractured vertebrae. Fractures were of the compression type, with no observed neurologic disturbances. The pilots returned to active jet service within four months, with a two-month average disability period. Roentgenographic examination revealed additional findings in 12 pilots, such as spondylolisthesis, Scheuermann's disease, etc,, abnormalities that may have been considered important had they been known before ejection. They did not give rise to symptoms or injuries. Injuries resulting from successful catapult ejection appear to be of a moderate nature. It is concluded that injured pilots should not be deferred from further active jet service, nor should otherwise healthy pilots be rejected because of an asymptomatic back abnormality.

1913
Hultgren, H.,
W. Spickard, and C. Lopez
FURTHER STUDIES OF HIGH ALTITUDE PULMONARY OEDEMA.—Brit. Heart Jour. (London), 24 (1): 95-102. Jan. 1962.

Six patients with acute high-altitude pulmonary edema are described (five children and one adult) who are residents of the Peruvian Andes. Either acute elevation of left ventricular diastolic pressure, or pulmonary venous constriction could be etiologic factors. The following factors may also be important in causing the syndrome: (a) peripheral vasoconstriction and shift of blood volume to thorax due to anoxia; (b) increase in blood volume; (c) increased cardiac output due to anoxia; (d) undue physical activity; (e) myocardial anoxia; or (f) increased capillary permeability due to infection or hypoxia. The attacks of pulmonary edema occurred from 9 to 36 hours after returning to an altitude of 12,250 ft. from a stay at sea level varying from two days to two months. Two cases proved fatal.

1914
Hunter, D.
THE DISEASES OF OCCUPATIONS.—Third edition. xvii+1180 p. Boston: Little, Brown and Company, 1962.

This book reviews the clinical aspects of the disease problem in relation to occupation. The opening chapters depict something of the historical, social, and economic background of the occupations men follow. Other chapters deal with the hazards posed by metals, aromatic carbon compounds, aliphatic carbon compounds, noxious gases; occupational diseases due to infections; occupational diseases of the skin; pneumoconioses; and accidents. Of special interest is Chapter 13 (p. 812-901) which is concerned with diseases due to physical agents and includes decompression sickness (aero-embolism of aviators, ascent and descent of divers and airmen, oxygen poisoning), heat cramps, occupational deafness and cramps, and the effects of vibrating tools. The symptoms, etiology, diagnosis, and treatment of these conditions are discussed. Included are an extensive subject index and bibliographies at the end of each chapter. (Many references)

1915
Juin, G.
[VERTEBRAL PAINS, OCCUPATIONAL DISEASES OF THE PILOT?] Les douleurs vertébrales, maladies professionnelles du navigant?—Pilote de ligne (Paris), No. 33: 54-59. 1963. In French.

A considerable increase in the incidence of painful vertebral disorders, originating from the aircraft seat, has been found in flying personnel. Many spinal disorders arise from the actual work conditions. The perpetual lateral torsion and flexion of the trunk of mechanics working on aircraft, and the various gestures of hostesses and stewardesses during flight under unbalanced conditions also contribute to cases of spinal pathology. The physician faced with patients with spinal problems must diagnose the disorder, analyze the exact causes, and prescribe curative and preventive treatment. Since spinal disorders appear to arise from human and materiel factors, it is suggested that the physician and engineer cooperate to protect the health and safety of aircraft personnel by modifying seat design, lessen vibrations (especially in helicopters), etc.

1916
Kopp, D. T.
GROUND POWER UNITS AS A NOISE HAZARD. — Tactical Air Command Surgeon's Bull., 3 (2): 1-2. May 1962.

During routine audiometric screening of maintenance personnel, three persons servicing aircraft at a ground power equipment maintenance station were found to have Class C hearing. A noise survey of the ground power equipment maintenance station revealed overall noise levels from 71 to 100 decibels, with greater than 85 decibels being the normal condition. It was noted that ground power units present almost as much of a problem with regard to acoustic trauma as jet aircraft. It is suggested that all aircraft bases canvass their flight line for noise sources other than those arising from aircraft, and educate line personnel in the use of acoustical protective devices.

1917
Lafontaine, E.,
J. Lavernhe, and J. Courillon
[PROTEINURIAS AND MEDICAL EVALUATION OF FLYING PERSONNEL] Proteinuries et expertise médicale du personnel navigant.—Revue de médecine aéronautique (Paris), 1 (3): 87-89. March-April 1962. In French.

Proteinuria in flying personnel is the object of intense clinical and paraclinical investigations concerning its rhythm and importance, the urinary sediment, renal function, and vesico-uretero-pyelo morphology, the latter by means of intravenous urography. It is recommended that flight candidates presenting proteinuria during initial medical examination be eliminated from training even though the pathological character is not yet evident. A renal lesion in flying personnel may be aggravated by obligatory vaccinations. In certain cases, minimal intermittent albuminurias which are purely orthostatic and without any renal abnormality are of no consequence for sedentary flying personnel such as liaison, light aircraft, or transport pilots. The presence of hematuria or functional renal disorders constitutes a case of incompatability with the profession of flying. The greater part of hematurias, however, permit the pursuit of a normal aviation career, provided that they are kept under continual observation.

1918
Laurell, L.,
and A. Nachemsson
SOME FACTORS INFLUENCING SPINAL INJURIES IN SEAT-EJECTED PILOTS.—Revue de médecine aéronautique (Paris), 1 (2): 195-196. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (1): 27-28. Jan. 1963.

A review is presented of a series of ejections made by Royal Swedish Air Force Personnel during 1957 to 1960. The risk of spinal fractures was slight as long as the ejection was made from aircraft flying in a controlled attitude, and reasonable time was allowed for assuming the proper body position for ejection. Only three out of 36 pilots ejected under these circumstances incurred fractures, involving a total of five vertebrae. The requirements of ejection velocity were not as high for the single-seater J 29 as for the two-seater J 32, so that lower peak-g values were accepted. With the seat used in the J 29 there was little risk of vertebral fractures even under the worst conditions. In the J 32 the requirements regarding seat performance apparently caused acceleration values to rise to a degree where ejection even under optimal conditions resulted in minor fractures in a few cases. The following factors appear to increase the risk of vertebral fractures in the J 32: ejection during negative acceleration, improper position in seat, and use of alternative ejection handle. No case of vertebral fracture resulted in permanent disability or reduced pilot efficiency.

1919
Lavernhe, J.,
E. Lafontaine, and S. Bemelmans
[AMEBIASIS AND COMMERCIAL AVIATION FLYING PERSONNEL] Amibiase et personnel navigant de l'aviation commerciale.—Revue de médecine aéronautique (Paris), 2 (7): 257-261. May-June 1963. In French.

A clinical analysis is reported of forty-two cases of amebiasis found in Air France flying personnel in 1961. The most frequent symptoms were non-dysenteric colitic disorders and neuro-vegetative syndromes. Therapy consists of Emetine and other anti-amebic drugs, sedatives, tranquilizers, etc. Morbidity statistics show a high incidence of amebiasis in flying personnel and indicate that flights to and from tropical zones with endemic ambiais are the factors responsible for outbreaks of the disease among flying personnel. The medico-legal aspects of the disorder are also discussed.

1920
Lisovskii, V. A.,
and M. K. Mikushkin
[THE EFFECT OF OXYGEN ON THE DEVELOPMENT OF EXPERIMENTAL ATHEROSCLEROSIS IN RABBITS] Vliianie kisloroda na razvitie eksperimental'nogo ateroskleroza u krolikov. — Patologicheskaia fiziologiia i eksperimental'naia terapiia (Moskva), 6 (1): 33-36. Jan.-Feb. 1962. In Russian, with English summary (p. 36).

Cholesterol (2 g./kg. of body weight) was administered to rabbits daily for a period of 2.5-4 months. The experimental group was placed into an oxygen tent (50-60% O_2) 3 to 6 times a week for a period of 2-2.5 hours. The average level of blood cholesterol in control rabbits was almost 3 times higher than in the experimental ones subjected to oxygen inhalation. The atherosclerotic changes in the aorta and the coronary arteries of the experimental group were less marked than in the control animals or were absent entirely. (Authors' summary, modified)

1921
Miller, D. L.,
J. C. McDonald, M. P. Jevons, and R. E. O. Williams
STAPHYLOCOCCAL DISEASE AND NASAL CARRIAGE IN THE ROYAL AIR FORCE. — Jour. Hygiene (Cambridge), 60 (4): 451-465. Dec. 1962.

The nasal carriage of *Staphylococcus aureus* and its relation to disease was studied in new recruits, boy apprentices, and trained men of the Royal Air Force. The proportions of *S. aureus* that were penicillin-resistant ranged from 15% in new recruits to 20% in trained men. In a school for apprentices the rate in new arrivals was 18% and 23% for boys after the initial training. 31% of the strains isolated from septic lesions were penicillin-resistant and the rate was similar in all types of units. About 1% of all strains isolated were resistant to tetracycline and streptomycin and much smaller proportions to chloramphenicol and erythromycin. Nasal carriers suffered from septic lesions more frequently than non-carriers and those with a lesion tended to suffer further lesions. Penicillin treatment resulted in a fall in the total carrier rate and a rise in the resistance rate. Phage type analysis showed that this was mainly due to elimination of sensitive strains and recolonization with resistant strains. (From the authors' summary)

1922
Miller, D. L.
THE INCIDENCE OF SEPSIS IN THE ROYAL AIR FORCE. — Jour. Hygiene (Cambridge), 60 (4): 467-471. Dec. 1962.

In 1956-1958 septic lesions in men of the Royal Air Force accounted for about 3% of all admissions to sickquarters or hospital, and about 5% of admissions excluding respiratory disease; 1% of all men in the service were admitted with sepsis each year. Incidence fell with age, particularly up to the age of 25 years. Recruits experienced more than twice as much sepsis as trained men and boy apprentices. Officers had only half the admission rate of other ranks. These contrasts may be explained by differences in age. There was no evidence of seasonal variation in the incidence of sepsis, but in recruits and boy apprentices epidemics of sepsis unrelated to season occurred. (From the author's summary)

1923
Montagard, F.,
J. Sais, and A. Guiot
[BACKACHE IN HELICOPTER PILOTS: FREQUENCY OF SCOLIOTIC DEVIATIONS] Les lombalgies des pilotes d'hélicoptère: fréquence des déviations scoliotiques. — Revue de médecine aéronautique (Paris), 1 (4): 30-32. July-Aug. 1962. In French.

Backache represents a major element of fatigue in helicopter pilots. Pain may be caused by constant repetition of the same movements, adoption of a faulty attitude which produces osteoarticular problems, microtrauma in the extremities resulting from lever operation, microtrauma in the vertebral column produced by the seat, and aircraft vibrations. Pilots with 1,500-2,000 hours of helicopter flying are liable to backache. Objective and radiological examination reveals slight scoliotic deviations with muscle contracture. Backache is usually of short duration and disappears following several hours or days of rest. The radiological and radio-clinical factors are discussed along with preventive (limitation of flying time, modification of levers and seats) and therapeutic (rest, physiotherapy) measures.

1924
Montero, R.
[PHYSIOLOGICAL RISKS IN FLIGHT] Riesgos fisiológicos en el vuelo. — Revista del viernes médico (Lima), 8 (1): 60-79. Jan.-April 1962. In Spanish.

A review is presented of the physiological problems encountered during high-altitude and space flight, such as hypoxia, negative and positive accelerations, ozone toxicity, and dysbarism. Manifestations of dysbarism include bends, chokes, and neurological disorders. The condition may be further complicated by aerotitis, aerosinusitis, and aerodontalgia. Consideration is also given to the hazards presented by meteorites, and cosmic, ultraviolet, and solar radiations during space flight.

1925
Nanchev, L.
[COLLAPSE WITH LOSS OF CONSCIOUSNESS IN A PILOT DURING FLIGHT] Kolaps sus zagubvane na suznanie u pilot po vreme na polet. — Voenno meditsinsko delo (Sofiia), 17 (2): 71-76. June 1962. In Bulgarian, with Russian summary (p. 76).

A case is described of collapse with loss of consciousness in a pilot during flight. The etiology is seen as a combination of the effects of an acute infection of the upper respiratory tract, insufficient rest the night before the flight, and a light degree of hypoxia and hyperventilation against a background of increased tendency to circulatory collapse.

1926
Neves Pinto, R. M.
[ACOUSTIC TRAUMA AMONG THE FLIGHT PERSONNEL OF VARIG AIRLINES (BRAZIL)] Trauma sonoro entre o pessoal de vôo da viação aérea Rio Grandense (Varig).—Revista brasileira de medicina (Rio de Janeiro), 19 (3): 140-143. March 1962. In Portuguese, with English summary (p. 143).

The following conclusions were drawn from a study of acoustic trauma in flying personnel of Varig Airlines: (1) a relation exists between flight activity and acoustic trauma; (2) a greater percentage of the cases of acoustic trauma were found in flight radio-operators (36.9%), followed by copilots (26.6%), pilots (26.3%) and flight stewards (17.3%); (3) the medium hearing threshold curves did not express the auditory reality of each group studied. Although all of them were within clinical normality, they masked up to 36.9% of the cases of typical acoustic trauma, especially in one of the groups investigated; (4) individual sensitivity to trauma plays an important role in the pathogenesis of acoustic trauma; (5) since radio-operators, pilots, and copilots presented the highest percentage of acoustic problems in the ears holding radio receivers, it is suggested that the radio is the injurious noise source aboard the conventional airplane; (6) a slight direct relation exists between flying time and acoustic trauma; and (7) there appears to be a slight relation between age and vulnerability to acoustic trauma. (Author's abstract, modified)

1927
Ong, S. G.
COSMIC RADIATION AND TUBERCULOSIS. III. INFLUENCE OF COSMIC RADIATION ON TUBERCULOSIS AT HIGH ALTITUDE AND AT SEA LEVEL. — Scientia sinica (Peking), 11 (5): 645-676. May 1962.

Tuberculous mice kept at high altitude (1,897 meters) showed a greater mean survival time than tuberculous mice at sea-level. This was due to the high intensity of low-energy cosmic particles at high altitude. Statistics on over 16,000 patients treated in sanatoria at high altitude (1,560 meters) and at sea-level or medium altitude show the benefit of treatment at high altitude: lower mortality rate and greater mean survival. Females at sea level show a greater mean survival time and lower mortality rate than males. At high altitude no significant difference was observed between the sexes, although they did not have the same mortality in each of the treatments. (Author's summary, modified)

1928
Payne, B. F.
GLAUCOMA AS AN AVIATION HAZARD.—Aerospace Med., 33 (11): 1328-1331. Nov. 1962.

A brief discussion is presented of the hazard of glaucoma in flying personnel, diagnosis of the disease by tonometry and peripheral vision tests, the effect of glaucoma on the eye, and the need for research concerning the production of glaucoma by flight.

1929
Payne, C. F.,
and R. A. Bosee
STUDY OF PHYSIOLOGICAL STRESSES WITH EJECTION LOADS: THE MECHANISM AND CAUSE OF CRASH LANDING AND EJECTION VERTEBRAL INJURIES IN U. S. NAVAL AVIATION.—Naval Air Material Center, Air Crew Equipment Lab., Philadelphia, Pa. (Problem Assignment no. C04AE13-9). Report no. NAEC-ACEL-467, July 8, 1963. [33] p.

The basic mechanism responsible for the production of crash landing and ejection vertebral injuries is the concentration of inertial and restraint force components on the front of the vertebrae by spinal flexion. Restraint of the upper body by the conventional system adds to the loading of the vertebral column to such an extent that the compression force on the vertebrae greatly exceeds the inertial force of the upper body. Thus, with an ejection acceleration or crash landing impact of 18 g, the compression force may be equivalent to the inertial force on the upper body of a 30 to 40 g acceleration. Restraint of the upper body by a harness of a proposed configuration does not add to vertebral loading; rather, in providing restraint, some support is given so that acceleration tolerance of the vertebral column is increased to above normal limits. (Authors' abstract)

1930
Rotondo, G.
[CLINICAL AND MEDICO-LEGAL CONSIDERATIONS CONCERNING AN ADDISONIAN SYNDROME OCCURRING IN A MILITARY PILOT AFTER LONG AND STRENUOUS FLIGHT ACTIVITY] Considerazioni cliniche e medico-legali su una sindrome addisoniana manifestatasi in un pilota militare dopo lunga ed impegnativa attività di volo.—Rivista di medicina aeronautica e spaziale (Roma), 26 (2): 291-306. April-June 1963. In Italian, with English summary (p. 304).

After a brief survey of the definition and pathogenesis of the peculiar occupational syndrome well known in aviation medicine as "pilot's fatigue", and on the assumption that in pilots, fatigued by flight, there is a state of relative hypocorticoidism, a remarkable case of Addisonian syndrome is described which appeared in a military pilot after a long-lasting and strenuous flight activity. The etio-pathogenic mechanism of this disease is examined and discussed. In this particular case one can possibly indicate, as a cause, a real exhaustion of the adrenal cortex. Thus the correlated medico-legal aspects are taken into consideration, with special regard to the causal connection with the particular occupational activity of piloting. (Author's summary)

1931
Rutstein, H. R.
ACUTE PHARYNGOTONSILLITIS IN AN AIR FORCE POPULATION: RESULTS OF 5,536 THROAT CULTURES.—Arch. Otolaryngol., 78 (1): 95-99. July 1963.

Of 5,536 throat cultures taken in a 12-month period from military personnel and their dependents with acute pharyngotonsillitis, 640, or 12%, revealed moderate to heavy growth of β-hemolytic streptococci. All patients were treated with penicillin or other indicated antibiotic drugs. 1,030, or 18% of the cultures, revealed moderate to heavy growth of potentially pathogenic bacteria.

1932
Tabusse, L.,
R. P. Delahye, and R. Pannier
[CONCERNING AN EJECTION DURING A SUPERSONIC AIRPLANE FLIGHT] A propos d'une éjection d'avion à vitesse supersonique.—Revue de médicine aéronautique (Paris), 2 (5): 53-57. Nov.-Dec. 1962. In French.

Observations on the pathological effects resulting from a 28-year-old pilot's ejection from an airplane traveling at supersonic speed (1 to 1.15 mach) are presented. The effects on the pilot included essentially hemiplegia of the left side and fractures of the 12th dorsal and 1st lumbar vertebrae. During ejection, the pilot was subjected to deceleration, rotation of the seat, and wind blast. The fractured vertebrae were probably the results of rapid impact with the soil.

1933
Vaandrager, K.,
and J. G. Grimm
CORONARY ARTERIOSCLEROSIS IN PILOTS: REPORT OF A CASE.—Revue de médecine aéronautique (Paris), 1 (2): 76-77. Dec. 1961-Jan. 1962. In English.

Also published in: Indus. Med. and Surg., 32 (1): 38-39. Jan. 1963.

A case is reported of general arteriosclerosis in an apparently healthy pilot, whose only symptoms were intermittent claudication. Although the possibility of coronary arteriosclerosis was suspected, no cardiologist was consulted. Post-mortem diagnosis confirmed the suspicions. In order to avoid the risk of pilots flying with coronary arteriosclerosis it is suggested that: (1) electrocardiograms (ECG) and two-step ECG's be made annually after the pilot has reached his 35th birthday, and prior to this at five-year intervals; (2) all ECG's be studied by a cardiologist and compared with former ECG's; (3) every physician examining a pilot with symptoms indicating acute coronary disease ground him until a cardiologist has been consulted; (4) both pilot and copilot be strapped securely to their seats in order to make handling of the plane possible should one suffer a heart attack and tend to fall over the controls; and (5) captain and copilot interchange flight duties periodically so that the copilot can efficiently take over in case of emergency.

1934
Zakharieva, Z.
[EFFECT OF ALTITUDE ON THE PHAGOCYTIC REACTION IN PATIENTS WITH ECZEMA] Influence de l'altitude sur la réaction phagocytaire chez les malades d'eczéma.—Folia medica (Plovdiv), 5 (1): 64-67. 1963. In French.

The conditions in high mountains at Pamporovo, Rhodope Mountains, Bulgaria (altitude approximately 1500 m.) increased the phagocytic activity of the leukocytes in patients with skin diseases. The cases consisted mostly of chronic eczema, but included several cases of urticaria, neurodermatitis, purpura, pruritis, pemphigus vulgaris, and Dühring's disease. An improvement or a complete cure was observed in 70.73% of the patients studied.

d. Pharmacology

1935
Autian, J.
PHARMACY AND THE SPACE PROGRAM.—Amer. Jour. Hospital Pharmacy, 20 (2): 92-93. Feb. 1963.

Bearing in mind that the original balloon flights made by man were carried out by the French pharmacist de Rozier, the author criticizes the pharmacy profession for not participating as a professional organization in the space program. It is proposed that the colleges of pharmacy must develop a program of their own dealing in research and training for space problems, and he coins the name astronautical pharmacy to represent these efforts. The author then reviews problems such as effects of space conditions on metabolism, and the need for various drugs by astronauts as areas of research for organized pharmaceutical investigation.

1936
Bättig, K.
[THE EFFECT OF TRAINING AND AMPHETAMINE ON THE ENDURANCE AND SPEED OF THE SWIMMING PERFORMANCE OF RATS] Die Wirkung von Training und Amphetamin auf Ausdauer und Geschwindigkeit der Schwimmleistung der Ratte.—Psychopharmacologia (Berlin), 4 (1): 15-27. 1963. In German, with English summary (p. 27).

The effects on swimming performance of a 7-day training period and a subsequent application of 1.5 and 4 mg./kg. amphetamine were measured in four groups of 10-12 rats each. In group 1 endurance was measured until the rats sank 40 cm. below the water surface; in group 2, until the rats were breathing out 40 cm. below the water surface. In these two groups training did not improve the performance; 1.5 mg./kg. amphetamine produced small but nonsignificant increments; and 4 mg./kg. amphetamine produced a significant improvement in performance. In group 3 the rats had to swim 10 times in a row toward an escape ladder at the end of the water alley. In group 4 the rats had to lift a load by pulling at a thread tied to their tails while swimming to the escape ladder. Training produced in group 3 a small improvement of swimming speed and in group 4 a large improvement; amphetamine had no effect on group 3 and produced an impairment in group 4 which was significant in the condition of pulling the load and just below the level of significance for the condition without load. These opposite effects of amphetamine on endurance and speed of swimming are discussed in terms of the different requirements of the two behavioral tasks. (Author's summary, modified)

1937
Bertelson, P.,
and R. Joffe
[THE EFFECT OF MEPROBAMATE AND EMYLCAMATE ON HUMAN PERFORMANCE IN A PROLONGED SERIAL TASK] L'influence du méprobamate et de l'émylcamate sur la performance humaine dans une tâche sériale prolongée. — Psychopharmacologia (Berlin), 3 (4): 242-253. 1962. In French, with English summary (p. 252).

Sixty-three normal subjects, divided into groups on the basis of performance during one session under a placebo, worked for 40 minutes on a self-paced four-choice key-pressing task after having ingested the tranquilizers, meprobamate or emylcamate, or a placebo. Speed was significantly impaired by both drugs, errors and blockings being unaffected. No difference was found between the two drugs. These results are considered as tentative. An interesting side result was the significant effect on the number of blockings of the length of very short interruptions between beginning of response and beginning of the next signal. (Authors' summary, modified)

1938
Carapancea, M.,
S. Simionescu-Carapancea, and M. Popescu
[OCULAR MANIFESTATIONS OF THE EFFECT OF STRYCHNINE ON THE BODY SUBJECTED TO CONDITIONS OF HYPOBARISM AT HIGH ALTITUDES] Manifestările oculare ale acţiunii stricninei asupra organismului, pus în condiţii de hipobarism la mari altitudini. — Studii şi cercetări de fiziologie (Bucureşti), 7 (1): 115-125. 1962. In Rumanian, with French summary (p. 124-125).

Large doses of strychnine greatly stimulate the higher nerve centers, which in turn stimulate the adrenal medulla and lower the threshold of excitability of the body. They result in generalized convulsions, nystagmiformic spasms, generalized retinal arteriolar spasms, and maximum bilateral mydriasis, leading to exhaustion and ultimate death. Small doses of strychnine stimulate the adrenal medulla to a lesser degree and raise the excitability threshold of the body to some extent. They stimulate the primary anti-anoxemic mechanism and increase the resistance of the body to hypobarism at high altitudes.

1939
Cutting, W. C.
GUIDE TO DRUG HAZARDS IN AVIATION MEDICINE.—Washington, D. C.: Aviation Medical Service, Federal Aviation Agency. xi+97 p. 1962.

This book, prepared for Aviation Medical Examiners, lists drugs, their toxic effects relevant to aviation, and a conservative estimate of their allowable use. The drugs are arranged so that related drugs are grouped under general therapeutic headings. Individual drug names are alphabetically arranged in the index. For ease of identification, trade names are given parenthetically after the nonpropriety name. Included are antibacterial and related agents, antifungal agents, antiprotozoal agents (antidotes), agents in tropical diseases, anthelmintics, anticancer agents, topical agents (insecticides, antiseptics, etc.), cardiovascular and smooth muscle agents, agents for immunology and allergy, hormones, blood, fluids and electrolytes, vitamins, agents in nutrition, sympathetic stimulants and depressants, parasympathetic stimulants and depressants, myoneural agents, anesthetics and therapeutic gases, non-narcotic and narcotic analgesics, antitussives, sedatives and hypnotics, anticonvulsants, tranquilizers, stimulants, psychic stimulants, and agents in alcoholism. Probably the best general recommendation for flying personnel and others directly associated with flight control, is abstinence from all drugs. However, some illnesses and symptoms may not preclude flying or ground traffic control work, but may be benefited by appropriate drugs.

1940
Düker, H.
[ON REACTIVE INCREASE IN EFFORT] Über reaktive Anspannungssteigerung.—Zeitschrift für experimentelle und angewandte Psychologie (Göttingen), 10 (1): 46-72. In German, with English summary (p. 71). 1963.

Experiments on the effect of very small doses of alcohol upon continuous tasks involving simple arithmetic showed a clear impairment of performance under the influence of 5 ml. of 80% alcohol, whereas under the influence of 10 ml. an increase in performance occurred. This increase came about as a result of apparent minor inhibitions caused by the 10 ml. doses of alcohol, whereby the subjects who aspired to high performance were stimulated to increased psychic exertion. This immediate reaction of the subjects to inhibitions (obstacles) during continuous activity, which manifested itself in an intensification of psychic exertion, is designated as reactive exertion increase. Further investigations involving continuous manual activity confirmed these results. Furthermore, it was shown that the reactive exertion increase was a phenomenon of general significance which takes place whenever obstacles occur in the course of continuous activity and when high performance aspiration obtains. An attempt is made to explain some of the experimental results found in the professional literature concerning performance increase, as well as the acceleration of work rate often found in daily life, in terms of reactive exertion increase. (Author's summary)

1941
Hannon, J. P.,
E. Evonuk, and A. M. Larson
SOME PHYSIOLOGICAL AND BIOCHEMICAL EFFECTS OF NOREPINEPHRINE IN THE COLD-ACCLIMATIZED RAT.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 783-787; discussion, p. 787-788. May-June 1963.

A series of experiments were performed with rats acclimatized to cold by exposure to 4°C. for 2-4 months and infused intravenously with norepinephrine. The liver appeared to be the primary site of heat production during norepinephrine calorigenesis. Norepinephrine caused a marked increase in blood flow to the liver, heart, kidney, and small intestine in the cold-acclimatized animal. Cardiac output was increased by about 60% during norepinephrine infusion. In warm-acclimatized animals norepinephrine caused an increase in cardiac output of about 20%, changes in tissue blood flow were in most instances qualitatively similar to those in cold-acclimatized animals. Norepinephrine infusion was associated with a marked lowering of the respiratory quotient possibly due to norepinephrine stimulation of lipid oxidation. Cold acclimatization had no effect on the norepinephrine induced formation of nonesterified fatty acids within tissue, but did cause a marked difference in the rate at which fatty acids were released to the incubation medium. No effect of cold acclimatization was seen on the capacity of epididymal fat to synthesize triglyceride from preformed palmitic acid. Norepinephrine was not the sole mediator of nonshivering thermogenesis, its calorigenic action predominated during the transition stage from one metabolitic steady state to another serving as a possible emergency mechanism to raise the metabolic rate quickly under conditions of severe cold stress.

1942
Heimstra, N. W.,
and A. McDonald
SOCIAL INFLUENCE ON THE RESPONSE TO DRUGS. III. RESPONSE TO AMPHETAMINE SULFATE AS A FUNCTION OF AGE. — Psychopharmacologia (Berlin), 3 (3): 212-218. 1962. In English.

Ninety-six 25-day-old male rats were divided into three groups. One of these groups was observed at 30 days of age, a second at 45 days of age, and the third at 75 days of age. Each group was divided into four subgroups subjected to the following conditions: administration of saline in a solitary observation box, saline with social stimulation, amphetamine in a solitary box, and amphetamine with social stimulation. Observed behavior included locomotion, barrier-directed (social) behavior, sniffing, grooming, and inactivity. Barrier-directed behavior was significantly higher for 75-day-old rats treated with amphetamine than for the other two amphetamine-treated groups. Barrier-directed behavior was also higher for 75-and 45-day-old amphetamine-treated rats than for saline-treated animals in the same age groups. The amount of general activity did not differ among the amphetamine-treated groups. (Authors' summary, modified)

1943
Johnson, G. E.,
E. A. Sellers, and E. Schönbaum
INTERRELATIONSHIP OF TEMPERATURE ON ACTION OF DRUGS.—In: Proceedings of the International Symposium on Temperature Acclimation. Federation Proceedings, 22 (3, part I): 745-747; discussion p. 748-749. May-June 1963.

In normal rats (at 30° C.) reserpine produced an initial increase and subsequent decrease in metabolic rate, with no change in body temperature. In cold-acclimated rats (four weeks at 2° C.) Reserpine increased metabolic rate at 30° C. without influencing body temperature. In acutely cold-exposed rats (at 2° C.) reserpine increased then decreased oxygen consumption, body temperature fell rapidly and the animals died. Chlorpromazine depressed oxygen consumption of normal and cold acclimated rats at 30° C. and acutely cold-exposed animals at 2° C. The metabolic rate of cold-acclimated rats at 2° C. was increased, which was preceded by an initial fall in body temperature. In normal rats noradrenaline increased the metabolic rate, also increased the oxygen consumption of cold-acclimated rats at 30° C., and rapidly depressed the oxygen consumption of acutely cold-exposed rats causing a large percentage of these animals to become hypothermic and die. Although sodium salicylate increased the metabolic rate of normal and cold-acclimated rats at 30° C., it decreased that of the acutely cold-exposed animals. Cold-acclimated rats did not show a decrease in thermogenesis after salicylate treatment. The effect of drugs on cold-exposed rats depends on the duration of exposure to cold prior to treatment. Immediately after exposure rats increase their heat production, largely through increases in skeletal muscle activity. Since the drugs produced a fall in metabolic rate, they inhibit heat production via shivering, and exert little effect on nonshivering thermogenesis.

1944
Jovy, D.,
H. Bruner, and K. E. Klein
MEASURING AND CRITICAL EXAMINATION OF THE INFLUENCE OF DRUGS ON THE PERFORMANCE ABILITY OF AVIATORS.—In: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London and Paris (1960 und 1961). Deutschen Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 60-73. Oct. 1963. In English and German.

Determination of pilot efficiency after taking drugs was measured by means of a variation of the pellet recorder used for determining the functional efficiency reserve under hypoxia. Maximun doses of four antimetics were tested: meclizine hydrochloride, a thiopropazate derivative, a benzhydryl-caffeine composition, and trimethobenzamide. Of the four, only the last lacked efficiency-impairing properties, In tests of three dosages of meprobamate tranquilizer, the number of persons dropping below normal in their efficiency increases with increasing doses. A barbituric acid derivative, a brome carbamide derivative, and ethanol resulted in similar efficiency decreases.

1945
Masci, E.
[EFFECT OF CAFFEINE ON DYNAMIC VISUAL PERFORMANCE REVEALED BY MEANS OF TACHISTOSCOPIC CAMPIMETRY] Influenza della caffeina sulla "performance" dinamica visiva rilevata mediante campimetria tachistoscopica. — Atti della Fondazione Giorgio Ronchi (Firenze), 17 (4): 340-346. July-Aug. 1962. In Italian, with English summary (p. 340).

The perception of visual targets by six subjects for a short period of time (1/6 second) was evaluated using tachistoscopic campimetry. Extension of the test for approximately an hour revealed fluctuations in performance typical of fatigue, and an increase in the number of errors. Ingestion of a small dose of caffeine (100-120 mg., corresponding to a cup of coffee or tea) caused a decrease in these fluctuations. Under the action of caffeine, the reflex activity of the visual sensory system increased. This effect is partially of sensory origin, due to excitation of the psychomotor centers in the cerebral cortex, and partially due to the peripheral nature of the nerve fiber reflex activity. Caffeine may be considered a stimulus to visual performance under physical or mental stress. Included are six representative graphs.

1946
Mendelson, J.,
and D. Bindra
COMBINATION OF DRIVE AND DRUG EFFECTS. — Jour. Exper. Psychol., 63 (5): 505-509. May 1962.

The effects of injections of chlorpromazine (1.5 mg./kg.) and an amphetamine-like stimulant, methylphenidate (4 mg./kg.), on a water-rewarded lever-pressing response were studied at several levels of thirst using 28 hooded rats as subjects. The results suggest that the higher the drive level, the greater the response rate in both the control and the drug conditions. Both chlorpromazine and methylphenidate decreased response rate. There were no significant differences between the mean absolute, or relative, decrements in response score produced by either of the drugs at the different drive levels. Methylphenidate failed to produce any marked decrement at the highest drive level; thus the response was less vulnerable to the effects of this drug at a high drive level than at low drive levels. (Authors' summary, modified)

1947
Miettinen, M.
EFFECT OF ACUTE ALCOHOL INTAKE ON SERUM CHOLESTEROL AND LIPOPROTEINS. — Annales medicinae experimentalis et biologiae Fenniae (Helsinki), 40 (4): 443-447. 1962. In English.

Twenty-eight men drank in the evening during three hours, 1.0-2.4 g. of alcohol per kg. (according to individually estimated tolerance). Blood samples for cholesterol analysis were taken before drinking, 30 minutes after drinking, and on the following morning. Alcohol intake caused no significant changes in the serum total cholesterol concentration or in the distribution of cholesterol in alpha and beta lipoproteins. (From the author's summary)

1948
Nash, H.
PSYCHOLOGIC EFFECTS OF AMPHETAMINES AND BARBITURATES. — Jour. Nervous and Mental Diseases, 134 (3): 203-217. March 1962.

Two hundred forty normal adult volunteers were each given one of six drugs under double blind conditions. The medications used were: (1) 10 mg. dextro-amphetamine sulfate, (2) 10 mg. dextro-amphetamine sulfate plus 65 mg. amobarbital, (3) 65 mg. phenobarbital, (4) 10 mg. methamphetamine hydrochloride plus 65 mg. phenobarbital, (5) placebo capsule, and (6) placebo tablet. Objective and subjective measures of various intellectual functions were obtained from the group before and after medication. Analyses of the test results show a soporific effect and easier flow of associations after phenobarbital medication; however, the dose was too small to produce a statistically significant effect. The findings for the three other doses reflect actions of the amphetamines expressed in an enhancement of the general intellectual capacity. Basically this apparent enhancement is due to the alerting action of amphetamines enabling the subject to devote close attention to the task at hand. The reticular formation is suggested as the site of action.

1949
Rahmann, H.
[THE EFFECT OF CAFFEINE ON THE MEMORY AND BEHAVIOR OF THE GOLDEN HAMSTER] Einfluss von Coffein auf das Gedächtnis und das Verhalten von Goldhamstern. — Pflügers Archiv für die gesamte Physiologie (Berlin), 276 (4): 384-397. 1963. In German, with English summary (p. 395-396).

A study was made of the effect of caffeine on the highest associative functions (discrimination learning, retention, relearning, and transposition ability) in 26 female golden hamsters. Five groups of hamsters were trained to discriminate between simple visual patterns after having received subcutaneous injections of 0.25, 0.5, 1, 3, or 10 mg. of caffeine per kg. of body weight. Control groups received equivalent injections of an isotonic solution of NaCl. Doses of caffeine at optimal levels (0.5 mg.) accelerated learning, improved learning of more difficult patterns, improved retention, raised the ability to recognize visually learned patterns in a transposed form, and increased reactivity. Larger doses gave impaired results, while doses of 0.25 mg./kg. had no visible effects. A comparison of results obtained with caffeine, metamphetamine, and chlorpromazine shows that the psychotropic drugs act on the highest associative functions in the same direction as on lower central nervous processes. Optimal doses of brain-stimulating drugs apparently have a favorable effect on concentration and intensity of reaction and hence on learning. The better retention and the capability of better recognizing the tasks in a changed form may be effects of stronger tracing during training.

1950
Uhr, L.,
A. Platz, and J. G. Miller
TIME AND DOSAGE EFFECTS OF MEPROBAMATE ON SIMPLE BEHAVIORAL TASKS.—Jour. General Psychology, 68 (2): 317-323. April 1963.

Sixteen male subjects, 21 years and older, were run in an own-control design under placebo and three dosages of meprobamate, 400, 800, and 1600 milligrams, to determine response curves over a four-hour evening test period. To control for possible diurnal cycle effects, two additional runs under placebo and 1600 milligrams were conducted from 8:00 to 12:30 p.m. Analysis of scores on four psychomotor tests and three personality check lists showed that on the fifth cycle, 1-1/2 hours after ingestion, there was no evidence that subjects performed differently under maximum drug dosage than under the comparable placebo. Significance tests between pre-ingestion as compared to post-ingestion drug performance for the maximum drug dosage showed no consistent drug effects. Comparison of these changes under placebo confirmed this finding. The placebo runs showed changes in performance through the four-hour period as large as those of the drug runs. (Authors' summary)

1951
Uyeda, A. A.,
and J. M. Fuster
THE EFFECTS OF AMPHETAMINE ON TACHISTOSCOPIC PERFORMANCE IN THE MONKEY. — Psychopharmacologia (Berlin), 3 (6): 463-467. 1962. In English.

Amphetamine was administered (0.75-1.5 mg.) to rhesus monkeys trained to perform choice-responses to pairs of briefly presented (10 milliseconds) visual cues. Slight improvement of mean accuracy and significantly shorter reaction time were found in the performance of the animals after injections of the drug. These results are similar to those previously obtained by electrostimulation of the mesencephalic reticular formation, and appear to support the hypothesis of a reticulotropic action of amphetamine. (Authors' summary)

1952
Weiner, H.,
and S. Ross
EFFECTS OF D-AMPHETAMINE SULFATE ON TIME AND BRIGHTNESS PERCEPTION IN HUMAN SUBJECTS. — Psychopharmacologia (Berlin), 3 (1): 44-50. 1962. In English.

Each of five subjects gave ½ estimates of several time and brightness standards, first without drugs, and then after oral administration of a placebo or d-amphetamine sulfate (15 mg.) in randomized order. Time fractionations without drugs were, in general, accurate and reliable, especially for the shorter time standards. Placebo and d-amphetamine sulfate did not affect the accuracy of time estimations, but both tended to increase the variability of these estimations within standards, especially for the longer time standards. The brightness fractionations of the subjects with or without drugs, on the other hand, underestimated the standards generally. The reliability of these estimations did not appear to be related differentially to the magnitude of the brightness standards. Both placebo and d-amphetamine sulfate tended to produce increases in the estimates of the brightness standards, relative to control curves, without affecting the reliability of these estimates in any systematic way. (Authors' summary, modified)

e. Transportation and Hospitalization of Patients

1953
AIR TRAVEL AND THE CARDIOPULMONARY PATIENT. — Postgraduate Med., 32 (4): 387-393. Oct. 1962.

Excerpts are presented from an Air Force film instructing the general practitioner how to estimate the effects of altitude on the ability of the cardiac patient wishing to travel by air to meet oxygen requirements. Consideration is given to the airline route, cabin pressurization, and other operational factors before the trip is recommended. The patient must be reasonably comfortable in a resting state at ground level, able to exercise sufficiently to board the plane, and able to stand mild anxiety. For the patient with an acute pulmonary disorder such as pneumonia or acute asthma, travel by air is best postponed until after recovery. An altitude of 8000 ft. is advised for minimally impaired patients, 6000 ft. for those cyanotic with emphysema, restrictive disorders, or alveolocapillary block, and 4000 ft. for emphysematous patients with two of the three indications of increased severity (blood oxyhemoglobin desaturation, respiratory acidosis, cor pulmonale) and for those with more severe cyanotic restrictive disorders.

1954
Barthes
[REPORT ON AEROMEDICAL EVACUATIONS] A propos des évacuations sanitaires aériennes. — Revue des Corps de santé des armées (Paris), 3 (2): 225-227. April 1962. In French.

In Algeria, primary aeromedical evacuation is provided for the rapid transportation of wounded requiring emergency surgery or complete treatment. Secondary evacuation, based on logistics, is regulated by the medical emergency with respect to contraindications, maximum flight altitude, preparation of evacuees, condition of the wounded, and supervision and care needed during flight. The value of using helicopters in evacuation is discussed.

1955
Branson, H. K.
CANADA'S AERIAL AMBULANCE.—AOPA Pilot, 6 (10): 58-61. Sept. 1963.

The Saskatchewan Air Ambulance Service, organized in 1946 as the world's only public air ambulance, transports emergency patients from remote mountain and rural villages for treatment at medical centers. Convalescent surgery cases are also carried from hospital to home. Planes are equipped with oxygen equipment, respirators, and other nursing aids. Mention is made of the types of aircraft and their maintenance problems, takeoff and landing hazards, fees, modifications of plane interior for patient and nurse, etc.

1956
Britton, J. H.
AVIATION MEDICINE AND PATIENT AIR TRAVEL. — Jour. Iowa Med. Soc., 52 (11): 708-714. Nov. 1962.

Some early accomplishments in military and civilian aviation medicine are given and similarities and differences in approach between these two branches are discussed. The duties of the military and civilian flight surgeons are quite similar; however, differences exist relating especially to the type of physical demands on civilian and military pilots. The major concern of practicing physicians not in aviation medicine is the ability of their patients to withstand flight. The physiologic aspects of normal responses to the abnormal environment are reviewed with regard to the method of evaluating the physical condition of a patient in respect to flight. With the exception of some serious physical disabilities and a few minor ones which might be complicated by changes in barometric pressure, most patients can tolerate flight satisfactorily. In fact, flight may be the preferable method of travel for many sick people. (Author's conclusions, in part)

1957
Carter, E. T.
CLINICO-PHYSIOLOGIC ASPECTS OF PASSENGER FLIGHT.—Connecticut Medicine, 27 (7): 385-389. July 1963.

The physical alterations of major clinical significance during commercial aircraft flight are (1) the decrease in tension of atmospheric oxygen and (2) the expansion of body gases. While the normal person can easily tolerate aberrations of the degree encountered in commercial aviation, persons with certain abnormalities pose a unique problem. Knowledge is needed of the physiologic responses to the environmental changes involved in flight before clinical judgment can be made in regard to the safety of flight for a given patient.

1958
Durand, M.,
and J. Bourdinaud
[AERIAL TRANSPORT OF CONGENITAL CARDIOPATHIES] Le transport aérien des cardiopathies congénitales.—Revue de médecine aéronautique (Paris), 2 (8): 410-414. Aug.-Sept. 1963. In French.

Cardiopathic patients which can be transported by land or sea are less stressed by air transportation provided that the proper hygienic and dietetic precautions are taken before and after the flight. Ideally, an ambulance airplane should be used, or at least a fully pressurized airplane with segregated quarters for the patients. The presence of medical escorts is required in certain cases and recommended in others. The airplane should also be provided with oxygen and overstuffed chairs or beds. Transportation of certain cases is contraindicated: all congenital cyanoses not treatable with oxygen, chronic or paroxymal dyspneas not reducible by therapeutics, and all cardiac cases in which death might result from minimal stress.

1959
Franque, E.
[SANITARY AERIAL EVACUATIONS. STUDY OF TECHNIQUES. TOTALS AND RESULTS EFFECTED

DURING THE A. F. N. UNDERGROUND WAR BY THE CENTER OF AIR HEALTH TRANSPORTATION OF THE FIFTH AERIAL REGION (1957 to 1962). II.] Les évacuations sanitaires aériennes. Études des techniques. Bilans et résultats réalisés au cours de la guerre subversive d'A. F. N. Centre de transit santé air de la 5^{e} région aérienne (1957 a 1962). II.—Revue de médecine aéronautique (Paris), 2 (8): 451-458. Aug.-Sept. 1963. In French.

The first section of the article summarizes the teachings and techniques in actual use in the transportation of patients by airplanes and helicopters. The training of nursing personnel, atraumatic methods of transfer to and from the aircraft, oxygen therapy, and maintenance of antiseptic isolated quarters are considered. A list is given of the most commonly used respiratory aid systems. The second section of the article reports the transportation of over 20,000 patients without serious aftereffects, and promises more rapid ambulance airplanes with still better facilities.

1960
Giannouli, G.,
and A. Kousoulakou

[INDICATIONS AND CONTRAINDICATIONS FOR AIRPLANE TRAVEL] Eis poious epitrepetai kai eis poious apagorevetai na taxidevoun aeroporikos. — Helliniki iatriki (Thessaloniki), 31 (8): 725-729. Aug. 1962. In Greek.

Persons with severe respiratory disorders (artificial pneumothorax, pneumonia, paroxysmal asthma) should not travel by air. Those with mild bronchiectasis, lung cancer, or lung disease may fly if no dyspnea is found upon physical examination. In general, patients with heart diseases or abnormalities may fly; those with severe cardiac conditions should not fly unless oxygen is on board. In patients with nervous system disorders and severe gastrointestinal disorders flight is contraindicated. Bone and bone marrow disorders appear to present no problem during flight. Blood disorders pose no problem except in cases where anemia is lower than 60% and necessitates the use of auxiliary oxygen supply on board. Diabetes, diphtheria, parotitis, and poliomyelitis patients may fly. Women in the eighth month of pregnancy may travel by air if there is no previous history of complication or abortion. Healthy aged persons may safely fly, but not infants less than 7 days of age.

1961
Hartmann, H.

[THE PATIENT AS A FLIGHT PASSENGER] Der Patient als Flugpassagier. — Therapeutische Berichte (Bayer Leverkusen), 34 (2): 50-54. 1962. In German.

Guidelines for evaluation of a patient's capacity for air travel are considered. In view of the improvements in pressurization systems in commercial aircraft flying is safe for most types of patients. Certain precautions are discussed for cases of anemia, angina pectoris, hypertension, pneumothorax, tuberculosis, post-operation, epilepsy, and pregnancy. It is suggested that airlines have flight surgeons accompany certain flights on dates specified in advance to make this type of transportation available for patients with a need for constant medical supervision.

1962
Krstić, N.

[AVIATION-MEDICAL EVACUATION] Vazduhoplovnosanitetska evakuacija.—Vojnosanitetski pregled (Beograd), 20 (4): 213-217. April 1963. In Serbo-Croatian.

A brief review is given of the development of air evacuation of the sick and wounded during World War II, and its advantages compared with other transportation methods are discussed. The equipment of helicopters, light planes, and larger transport planes used in evacuation is outlined. The remainder of the paper deals with the organization of the evacuation service in war and peace and with the precautions necessary on account of possible hypoxic conditions during air transportation.

1963
Lafontaine, E.,
and J. Lavernhe

[TRANSPORTATION OF PATIENTS ON COMMERCIAL AIRCRAFT. I AND II.] Le transport des malades à bord des avions commerciaux. I & II.—Presse médicale (Paris), 70 (5-6): 243-244, Jan. 27, 1962; 301-304. Feb. 3, 1962. In French.

The stresses characteristic of commercial aircraft (altitude changes, accelerations, noise, vibrations, time and climatic changes) which may affect the body are discussed. Modern aircraft is pressurized and the problem of hypoxia is negligible and usually tolerated by patients. However, atmospheric depression may prove hazardous for several pathological conditions. Patients for whom flight is contraindicated are those with coronary insufficiency, severe cardio-respiratory disorders, vascular thrombosis, acute broncho-pulmonary suppurations, excavated or hemoptoic tuberculosis, intestinal occlusion, digestive disorders with imminent organic perforation or hemorrhage, intracranial hypertension, otitis, mastoiditis, acute sinusitis, eye diseases, and psychopathic conditions. For certain disorders, aircraft flight necessitates the use of oxygen therapy, neuro-sedative treatment, anti-motion sickness drugs, dietetic measures, etc. The presence of a physician on board is advisable, although on international flights this poses legal problems as to the validity of diplomas, etc. In the majority of cases, airplane transportation represents the solution for long-distance travel of patients.

1964
Lederer, L. G.

CARDIOPULMONARY CONDITIONS: THEIR ASSESSMENT FOR CRITERIA FOR PASSENGER FLYING.—Connecticut Med., 27 (7): 396-399. July 1963.

The indications and contraindications for passenger flying are outlined for various conditions. These include orthopedic deformities of the chest, diseases of the diaphragm, pleura, mediastinum, trachea, bronchi, lungs (pneumonia, mycotic infections, abscesses, pneumoconiosis, emphysema, fibrosis, cysts, carcinoma, atelectasis), and tuberculosis. Also considered are such cardiovascular conditions as pulmonary infarction and/or embolus, arteriosclerotic heart disease, hypertension, rheumatic heart disease, congenital heart defects, and recent myocardial infarct. It is emphasized that, on the whole, if a patient can be transported at all, he can usually be transported by commercial air travel.

1965
Schreuder, O. B.
GENERAL MEDICAL PROBLEMS IN PASSENGER FLYING.—Connecticut Med., 27 (7): 390-395. July 1963.

In most instances air travel is an excellent means of transporting a patient if he can be transported by any mode of travel; however, there are several contraindications of flight in scheduled airline operations. These involve patients with acute severe glaucoma, respiratory infections, allergic rhinitis, fractured jaw, diabetes, severe anemia, leukemia, digestive tract disorders (bleeding or perforating peptic ulcer), neuropsychiatric disorders, communicable diseases, and some stretcher cases. Infants and the aged travel by air well provided there is no underlying pathology. Pregnant women also tolerate flying, although some airlines have restrictions. Consideration is given to procedures in the acceptance of patients for travel.

1966
Wright, C. C.
FACTORS INFLUENCING AIR TRANSPORTATION OF SICK AND INJURED. —— Jour. Occupational Med., 4 (12): 732-736. Dec. 1962.

Successful air transportation of the sick and injured is dependent upon the careful selection and preparation of the patient and the aircraft. Atmospheric factors of decreased total pressure, oxygen partial pressure, humidity, and temperature must be taken into account. Airline-passenger selection criteria are discussed, and a patient classification system is presented. Specific comments are made on the following factors: hypoxia, dysbarism, acceleration, weather, patient's mental attitude, time and timing, choice of vehicle, special equipment and the problem of loading and unloading. If a patient for any reason should be moved any significant distance, he may be moved with greater comfort, safety, speed, and economy by air than by any other means of transportation. (Author's summary)

f. Physical and Neuropsychiatric Examination

1967
Allebach, N. W.
CARDIOVASCULAR STUDIES AT THE U. S. NAVAL SCHOOL OF AVIATION MEDICINE WHICH HAVE DIRECT APPLICATION TO PRIVATE PRACTICE.—Jour. Louisiana State Med. Soc., 115 (9): 289-299. Sept. 1963.

The diagnosis of asymptomatic coronary artery heart disease in naval aviation cadets is discussed, and follow-up observations made on some of these cases over a 21-year period. The blood pressure, electrical plane of the heart, vectorelectrocardiogram, and work electrocardiogram are considered in relation to the heart disease problem. The clinical value of the modified step-test is stressed.

1968
Allen, T. H.
MEASUREMENT OF HUMAN BODY FAT: A QUANTITATIVE METHOD SUITED FOR USE BY AVIATION MEDICAL OFFICERS.—School of Aerospace Medicine. Aerospace Medical Division, Brooks Air Force Base, Tex. (Task no. 775801). Technical Documentary Report no. SAM-TDR-63-45, June 1963. iii+6 p.

Various volumes of the body are obtained by displacement of water in a specially constructed volumeter. From the total body tissue volume and body weight, one calculates the quantity of body fat. A comparison of two subjects illustrates points of interest in physical examinations. Although a man can be greatly overweight, as judged from height:weight tables, he is not necessarily obese due to fat. Another man can weigh only slightly more than the USAF standard and have an exceedingly large amount of body fat, actually enough to be considered obese. (Author's abstract)

1969
Boer, E. de
J. Carels and A. J. Philipszoon
THE TORSION SWING: A SIMPLE ROTATION TEST.—Acta oto-laryngologica (Stockholm), 56 (4): 457-460. May 1963.

A simple rotation test, the torsion-swing test, was used as a clinical method for the examination of the horizontal semicircular canals. By means of electronystagmography the per-rotatory horizontal nystagmus during movements of this swing was recorded. The difference between the total number of nystagmus beats to the left and total number of beats to the right during the first ten swingings was expressed as a percentage of the total number of beats. The mean and standard deviation of this difference between left- and right-beating nystagmus in 80 normal subjects were calculated. A directional preponderance greater than 23% (double standard deviation) was an indication of pathology. (Authors' abstract)

1970
Bordes, L. R.,
and P. Robert
[CUPULOMETRY (ELECTRONYSTAGMOGRAPHY) AND CRANIAL POST-COMMOTIONAL SYNDROME] Cupulométrie (électronystagmographie) et syndrome cranien post-commotionnel.—Revue de médecine aéronautique (Paris), 2 (7): 219-224. May-June 1963. In French.

Six cases are reported of the subjective cranial post-commotional syndrome (headache, vertigo, ocular and mental symptoms) effectively diagnosed by means of electronystagmography. This technique may be of great value in aviation medicine in cases where a decision must be made as to whether a pilot having suffered cranial trauma may or may not continue to fly.

1971
Cardus, D.,
U. C. Luft, W. A. Spencer, and H. E. Hoff
CONSIDERATIONS ON APPRAISAL OF PHYSICAL FITNESS. —— Arch. Physical Med. and Rehabilitation, 43 (5): 222-227. May 1962.

A review and analysis of the concepts of physical fitness are presented. Previous studies show that estimations of human physical fitness refer to a specific task. If comparable measurements are to be made on different persons, then the task has to be defined and the methods standardized. Physiologic measurements for objective expression of physical fitness must afford criteria for medical appraisal of the physical condition of acutely or chronically disabled persons in the course of a disease and in the process of rehabilitation. Such measurements also would permit matching military demands, and would prepare man for the challenge of adapting to new environments. A discussion concerning the concepts, selection, and difficulties of the methods to be used is given. (Authors' abstract, modified)

1972
Castet,
Tadei, Ducros, Cavalan, Besson, Damey, and Gilles
[FURTHER DATA ON THE EARLY RECOGNITION OF CORONARY ATHEROSCLEROSIS IN MILITARY AVIATION PERSONNEL] Données complémentaires sur le dépistage précoce de l'athérosclérose coronarienne parmi le personnel navigant de l'armée de l'air.—Revue de médecine aéronautique (Paris), 2 (8): 384-394. Aug.-Sept. 1963. In French.

In order to track down latent cases of coronary atherosclerosis in the air force tests are described which should be routinely performed. From an original study of 250 subjects, it was determined that only simple, rapid, well standardized tests should be used in the following categories: arterial heredity, smoking excess, android biotype, obesity, arterial hypertension, and anomalies in blood lipoproteins, coupled with a cardiovascular examination. Subsequent tests were sometimes necessary, such as those for glycemia, uremia, lipemia, cholesterolemia, and a lipidogram. In order to determine the statistical probabilities of coronary disease, the tests should be carried on for several years.

1973
De Francesco, E.,
and R. Caporale
[COLLECTIVE AUDIOMETRY IN THE SELECTION OF FLYING PERSONNEL] L'audiometria collettiva nella selezione del personale aeronavigante. — Rivista di medicina aeronautica e spaziale (Roma), 25 (1): 87-110. Jan.-March 1962. In Italian, with English summary (p. 108).

A new method is described for tone and speech audiometry which permits rapid examination of a group of 12 or more persons. It also permits objectivation of the values obtained in each test by means of a paper and pencil test carried out by the subjects. As compared to other audiometric techniques, this method proves to be more practical and accurate and the results are easy to standardize. From the medico-legal viewpoint it is fairly reliable. A graphic comparison is made between speech and tone audiometry. This method is very useful when applied to the selection of groups of pilot candidates in a limited time.

1974
Delahaye, R. P.,
and P. Edouard
[RADIOPHOTOGRAPHY IN THE CONTROL OF APTITUDE OF FLYING PERSONNEL: REPORT ON 10,000 RADIOPHOTOGRAPHS MADE BY THE CENTRE PRINCIPAL D'EXPERTISE MEDICALE DU PERSONNEL NAVIGANT] La radiophotographie dans le controle d'aptitude du personnel navigant: à propos de 10,000 radiophotographies realisées au C.P.E.M.P.N. — Revue de médecine aéronautique (Paris), 1 (4): 57-62. July-Aug. 1962. In French.

A discussion is presented of the radiophotographic technique used for the detection of pulmonary disorders in civilian and military flying personnel submitted to periodic medical examination, and in flight candidates. Of the 10,000 radiophotographs studied, 24 showed tertiary evolutive tuberculosis, 3 acute lung disorders, and 1 Besnier-Boeck-Schaumann disease with mediastinal ganglion manifestation. This technique is easy to perform and permits the early diagnosis of a pulmonary pathological process. Consideration is given to the possible radiological risk to subjects undergoing frequent periodic examinations, and to imperfections of the technique.

1975
Flynn, J. T.
THE FAA PHYSICAL. — Flying, 70 (2): 62, 108-109. Feb. 1962.

A discussion is given of the Federal Aviation Agency's (FAA) physical examination and of the preparations a pilot can make to aid himself in passing the physical. Most of the tests are routine and the pilot has only to be calm and rested, but in hearing and eye tests various suggestions are given to enable the pilot to best prepare himself and make maximum use of his eyes and ears.

1976
Fragoyannis, G.,
and E. Georgiadis
[MODIFICATION OF ELECTROCARDIOGRAPHIC CRITERIA OF AURICULAR HYPERTROPHY IN SINUS TACHYCARDIA] Modification des critères électrocardiographiques de l'hypertrophie auriculaire dans la tachycardie sinusale.—Revue de médecine aéronautique (Paris), 2 (8): 375-379. Aug.-Sept. 1963. In French.

The electroencephalographic manifestations of auricular hypertrophy are described with respect to the P (pulmonary) wave. Based on an analysis of 1591 cases, it has been shown that certain normal and abnormal factors influence the P wave; for example, it is changed in certain normal indivduals whose heartbeat rate is over 100 per minute. These findings should be considered in the examination and selection of flight personnel.

1977
Gandevia, B.
PULMONARY VENTILATION ON EXERCISE AND THE FACTORS AFFECTING A SIMPLE STANDARDIZED EXERCISE TEST. — Amer. Rev. Respir. Diseases, 85 (3): 378-386. March 1962.

A five-minute exercise test is described in which the ventilatory response to a known amount of work is measured and the result expressed in terms of ventilatory requirement at a standard work level of 300 kilogram-meters per minute. Experimental validation of the procedure is presented, together with data on normal standards and on the influence of such factors as age, sex, smoking, and athletics. The effect of psychologic factors on the results, especially at low work levels, is indicated. The value of the test as a simple, practical, and routine method of assessing cardiorespiratory function is briefly outlined. (Author's summary, modified)

1978
Hermann, E. R.
AN AUDIOMETRIC APPROACH TO NOISE CONTROL.—Amer. Indus. Hyg. Assoc. Jour. 24 (4): 344-356. July-Aug. 1963.

Using pure-tone audiometry an Early Loss Index (ELI) for hearing is developed based upon quantitation of the 4000-cycle-per-second notch. Hypotheses based upon probability theory and age- and sex-specific presbycusis values are presented, diagnostic levels of hearing impariment are selected and data drawn from an industrial population of 5000 people are used to provide experimental validation of the theory. Combining the ELI with the National Research Council's Speech Average Loss (SAL) method for measuring hearing impairment in the speech-important frequencies, a basis is provided for prescribing occupational health measures. A simple three-letter characterization of the essential audiometric findings on employees is proposed which should be quite useful in preventing the encroachment of ELI on SAL among the noise-exposed. (Author's abstract)

1979
Hinchcliffe, R.,
and R. J. Voots
AN ELECTRONYSTAGMOGRAPHIC TECHNIC FOR THE EXAMINATION OF VESTIBULAR FUNCTION. — Neurology, 12 (10): 686-697. Oct. 1962.

A technique of precision examination of vestibular nerve function, using combined paper and photo-oscilloscopic recordings of corneo-retinal potentials, is described. These recordings furnish information regarding the two basic electronystagmographic signs of vestibular dysfunction, namely, (1) vestibular paresis or hypofunction and (2) vestibular spontaneous nystagmus and vestibular-type directional preponderance. Included are explanatory recordings and graphs.

1980
Juin, G.
[CERTAIN CARDIAC DISEASES: OCCUPATIONAL HAZARD OF FLYERS?] Certaines affections cardiaques: accident du travail chez les navigants? — Pilote de ligne (Paris), no. 28: 61-65. March 1962. In French.

Since myocardial infarction or other coronary disorders may appear in flying personnel at any time and interfere with the execution of their profession, French pilots are subjected to detailed medical examination every 6 months. Special consideration is given to cardiovascular function as evaluated by clinical tests and the electrocardiogram. Other personnel are subjected to similar examination, although less extensive, once a year. This medical visit is required for the renewal of a pilot's license, to keep flyers physically fit during their career, and to screen any disorder that might prove incompatible with flying.

1981
Koch, C.
[ELECTROENCEPHALOGRAPHIC REACTIONS AFTER VESTIBULAR STIMULATION] Risposte elettroencefalografiche dopo stimolazione vestibolare.—Rivista di medicina aeronautica e spaziale (Roma), 26 (2): 263-272. April-June 1963. In Italian, with English summary (p. 269-270).

Simultaneous recording of the electroencephalogram and electronystagmogram after vestibular stimulation (rotation) has confirmed the somewhat disputed existence of vestibular cortical areas in the temporal, parietal, and frontal lobes. In the normal electroencephalogram, vestibular stimulation essentially does not change the frequency or amplitude of the cortical bioelectric activity. In many cases of cerebral pathology, however, vestibular stimulation brings about a lowering of the cortical activity due to inhibitive action from the nystagmogenic and oculomotor areas. This method of simultaneous recording is useful in the physical examination of pilots and other persons in which normal vestibular function is of importance.

1982
Kottke, F. J.,
W. G. Kubicek, M. E. Olson, R. H. Hastings, and K. Quast
FIVE STAGE TEST OF CARDIAC PERFORMANCE DURING OCCUPATIONAL ACTIVITY. — Arch. Physical Med. and Rehabilitation, 43 (5): 228-234. May 1962.

A five-stage standardized work test has been developed to provide reference conditions under which cardiac performance can be assessed. The levels of activity selected were (1) supine basal rest, (2) sitting rest, (3) hand activities increasing cardiac work to 125% of the basal output, (4) bilateral arm activities increasing cardiac work to 200% of the basal level, and (5) activities increasing cardiac work to 300% of the basal amount. The changes in cardiac parameters, including oxygen consumption, pulse rate, arteriovenous oxygen difference, effective arterial blood pressure, electrocardiogram, cardiac output and cardiac work rate, in response to these activities, were studied for 6 normal young men. The stages of the test cover the energy range within which most vocational activities are performed and provide a basis for a test of cardiac competence for a return to work. (Authors' abstract)

1983
Lansberg, M. P.
ON STANDARDISATION OF THE VESTIBULAR EXAMINATION.—Aeromedica acta (Soesterberg, The Netherlands), 8: 137-142. 1961-1962. In English.

The lack of a uniform method of examination and recording of the equilibrium sense is deplored, particularly in view of the frequency of complaints of dizziness and the serious implications of neurological pathology. Electronystagmography is recommended as the most sensitive method of vestibular examination, which permits the description of nystagmus in terms of duration, strength, and direction. It can be carried out at every medical center with an electroencephalograph. The base line curve should be a stimulus free recording followed by a positional test. Next, the caloric test is preferred because it does not require complicated equipment and facilities and permits separate testing of both labyrinths. A standard procedure is described which should be strictly observed. It is not very time consuming nor subject to the effects of habituation. Suppression may be counteracted by having the subject's attention diverted to something else, e.g., doing mathematical problems. A standard procedure of plotting the data is outlined.

1984
Lauschner, E. A.
[REFLECTIONS ON CARDIOVASCULAR EXAMINATIONS IN INITIAL SELECTION OF FLIGHT PERSONNEL] Réflexions sur l'examen cardio-vasculaire lors de la sélection initiale du personnel navigant.—Revue de médecine aéronautique (Paris), 2 (8): 458-462. Aug-Sept. 1963. In French.

Cardiovascular examinations of flight candidates have three purposes: (1) to eliminate sick candidates; (2) to evaluate the functional limits of the system through well-defined stress reactions; and (3) to reveal any premature arteriosclerosis. Test methods in common usage in seven occidental countries are compared and found to be similar and satisfactory, although different countries assign different values to the test results. Stress determination tests are difficult to compare due to differences in methods. Since the early detection of susceptibility to coronary vessel deterioration is of prime importance to professional fliers, such tests should be carefully evaluated.

1985
Matthäus, W.,
and H. Lantsch
[A PROJECTION DEVICE FOR THE OBJECTIVE AND SUBJECTIVE DETERMINATION OF VISUAL ACUITY] Ein Projektionsgerät zur objektiven und subjektiven Sehschärfebestimmung.—Klinische Montasblätter für Augenheilkunde (Stuttgart), 142 (2): 382-388. March 1963. In German.

A projection device for the objective determination of visual acuity is presented which functions on the basis of optokinetic nystagmus. The apparatus can also be used for the subjective determination of vision by projection of the customary optotypes.

1986
Miller, E. F.,
and A. Graybiel
A COMPARISON OF OCULAR COUNTERROLLING MOVEMENTS BETWEEN NORMAL PERSONS AND DEAF SUBJECTS WITH BILATERAL LABYRINTHINE DEFECTS.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001) and National Aeronautics and Space Administration, [Washington, D. C.] (Order no. R-47). Joint report [Unnumbered], Feb. 18, 1962. ii+9 p.

Counterrolling as a function of head (body) tilt was measured by a photographic technique in nine normal and ten labyrinthine defective (L-D) subjects to determine the functional status of their otolith organs. The findings in the normal subjects revealed a characteristic pattern of counterrolling. Ocular torsion as a function of head tilt rightward or leftward was greatest in the first 25 degrees from the upright, less from 25 to 50 degrees where it usually reached peak value, and thereafter in most cases tended to reverse direction. The average maximum value (counterrolling index, CI) ranged from 286 to 465 minutes of arc. The L-D subjects did not disclose the "normal" counterrolling pattern in most instances and their CI ranged from only 30 to 176 minutes of arc. The highly significant intergroup differences were attributed to loss of function of the auricular sensory organs; intraindividual differences in the L-D group were explained by the presence of some residual otolith function. (Authors' abstract)

1987
Panian, Z.
[OPHTHALMOLOGIC PROBLEMS OF THE TECHNICAL AVIATION PERSONNEL] Oftalmološki problemi tehničkog osoblja u vazduhoplovstvu.—Vojnosanitetski pregled (Beograd), 19 (3): 213-215. March 1962. In Serbo-Croatian.

Modern air traffic control and air navigation and safety depend, to a great extent, on ground-based radar installations. Radar operation presupposes a perfect functioning of the visual system of the operator. However, the operator is subject to visual fatigue. Small deviations from normal vision, such as slight ametropia, heterophoria, faulty accommodation, or deficient retinal adaptation are particularly liable to induce premature visual fatigue. Noise and high temperature likewise interfere with radar operation, as does insufficient ventilation of the work area. The necessity of a detailed ophthalmologic examination and continual supervision of radar personnel are stressed.

1988
Panian, Z.
[COMPARATIVE EXAMINATION OF VARIOUS METHODS OF TESTING COLOR VISION ANOMALIES AND THEIR PRACTICAL SIGNIFICANCE] Komparativno ispitivanje različitih metoda za otkrivanje anomalija u raspoznavanju boja i njihov značaj u praksi—Vojnosanitetski pregled (Beograd), 20 (5): 268-273. May 1963. In Serbo-Croatian.

After discussing the physical and physiological principles of color vision, the author compares the results obtained on 34 persons (including normal and color-blind) with the application of six test methods (Ishihari, Rabkin, Stilling, AOHRR, Nagel, and Giles-Archer). The individual findings are tabulated. In practice the most advantageous method is that of Ishihari, the most precise analysis that by Nagel's anomaloscope.

1989
Puccinelli, R.,
M. B. Cailler, R. Flandrois, and P. Bouverot
[INTEGRATION OF THE INTERSYSTOLIC INTERVALS BY MEANS OF AN ANALOG FREQUENCY METER OF RAPID RESPONSE: PHYSIOLOGICAL APPLICATIONS] Intégration des intervalles intersystoliques à l'aide d'un fréquencemètre analogique à réponse rapide: applications physiologiques.—

Revue de médecine aéronautique (Paris), 2 (8): 371-375. Aug.-Sept. 1963. In French.

A cardiac frequency meter is described which could be useful in the selection and protection of flight personnel. The apparatus consists of an electronic orthochronograph with an attached recording device and permits the instantaneous record and total of cardiac frequency, plus sound amplification. Its built-in electronic preamplifier for the electrodes suppresses background noise. It can measure electrical impulses from 30 to 450 cycles per minute and has been used on man, dog, and rat both active and at rest.

1990
Rišavi, A.
[THE ROLE OF ELECTRONYSTAGMOGRAPHY IN THE EXAMINATION OF THE FUNCTION OF THE VESTIBULAR APPARATUS] Uloga elektronistagmografije u ispitivanju funkcije vestibularnog aparata.—Vojnosanitetski pregled (Beograd), 20 (5): 301-305. May 1963. In Serbo-Croatian.

The theory and application of electronystagmography in the examination of the vestibular function are discussed. The method permits the precise determination of the latency, duration, frequency, and amplitude of primary and secondary nystagmus. Representative graphs are reproduced.

1991
Robert, A.,
E. Lafontaine, and A. Lucas
[THE IMPOSSIBILITY OF THE DIRECT UTILIZATION OF A HEARING LOSS SCALE IN THE PSYCHO-PHYSICAL SELECTION OF FLYING PERSONNEL] L'impossibilité d'utilisation directe d'une échelle de perte auditive dans la sélection psychophysique du personnel navigant. — Revue de médecine aéronautique (Paris), 1 (4): 28-29. July-Aug. 1962. In French.

A hearing loss index expressed in percent proposed by the American Medical Association Council on Physical Therapy in 1947 is discussed. The classic audiometric steps of 5 to 5 decibels are found for the frequencies 500, 1000, 2000, and 4000, the numbers indicating, according to the scale, the percentage of hearing loss. This scale is inadequate for characterizing the disorders of sensation since it can not express the dissociation characteristics between the increase of physical intensity and the increase of subjective intensity. In the selection of flying personnel, the scale should be modified to include the hearing function changes involving an elevation of the thresholds for critical frequencies attributed to toxic or traumatic etiologies, and the 3000 frequency which is important in telecommunication.

1992
Severin, S. L.,
J. Y. Harper, and J. F. Culver
THE PHOTOSTRESS TEST FOR THE EVALUATION OF MACULAR FUNCTION.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775101). Technical Documentary Report no. SAM-TDR-63-47, June 1963. iii+8 p.

A technic is presented for evaluation of the performance of the retinal macula that is based on precisely measuring the time required for a subject to recover sufficient visual function to perform defined visual tasks after he has been dazzled with an intense flash of light. The process of delivering photic energy to the retina has been termed photostress and the term photofatigue has been proposed to graphically described the condition of the retina after photostress. Cases studied are presented that will aid in the evaluation of this test in the study of macular disease, and a possible mechanism is discussed. (Authors' abstract)

1993
Smith, J. L.
OPTOKINETIC NYSTAGMUS: ITS USE IN TOPICAL NEURO-OPHTHALMOLOGIC DIAGNOSIS.—xi+141 p. Springfield: Charles C. Thomas, 1963.

The clinical uses of optokinetic nystagmus as a rapid, simple, objective test are outlined for the diagnosis of lesions in the temporal lobe, parietal lobe, occipital lobe, and brain stem. Vertical optokinetic nystagmus is discussed. (159 references)

1994
Soussen, G.,
R. Boiteau, H. Puisieux, and Pagliano
[SEARCH FOR SMALL DOSES OF BARBITURATES IN THE BLOOD: ITS SIGNIFICANCE FOR THE EEG APPLIED IN SELECTION, AND DISCOVERY OF HIDDEN EPILEPSY] Recherche de faibles doses de barbituriques dans le sang: son intérêt en E. E. G. appliquée à la sélection, dans la recherche des comitialités camouflées.—Revue de médecine aéronautique (Paris), 2 (8): 380-383. Aug.-Sept. 1963. In French.

Hidden or latent cases of epilepsy can be brought out with electroencephalographic tracings coupled with spectrophotometric analysis of the blood plasma. Electroencephalographic tracings of a certain amplitude and frequency, especially of the anterior brain, are known to be associated with drug intake. Barbiturates are known to remain in the blood for long periods of time.

1995
Tabusse, L.,
and R. P. Delahaye
[BRONCHIAL DILATATION AND FLYING PERSONNEL] Dilatation des bronches et personnel navigant.—Revue de médecine aéronautique (Paris), 1 (3): 76-80. March-April 1962. In French.

Motivated by flight, candidates for flight training tend to camouflage any condition such as recurrent bronchitis, hibernal bronchorrhea, or episodes of pulmonary congestion, that may alert the examining physician to disqualify them. Radiological methods (radioscopy, radiography, radiophotography) are the best means of detecting beginning bronchial dilatation, which often goes undetected in flying personnel and flight candidates. A comparison of the subject's previous medical history, radiological examinations, and function tests permits the detection of bronchiectasis. The only confirmatory examination is bronchography. Two cases are reported, with X-ray photographs, demonstrating latent bronchial dilatation in flight candidates.

1996
Tillman, T. W.,
R. Carhart, and L. Wilber
A TEST FOR SPEECH DISCRIMINATION COMPOSED OF CNC MONOSYLLABIC WORDS (N.U. AUDITORY TEST NO. 4).—Northwestern Univ., Evanston, Ill. (Contract AF 41(657)-418); issued by School of Aerospace Medicine, Brooks Air Force Base, Tex. (Project no. 7755, Task no. 59670). Technical Documentary Report no. SAM-TDR-62-135, Jan. 1963. iii+22 p.

The Northwestern University Auditory Test No. 4 is composed of two lists of 50 CNC [consonant-vowel-consonant] monosyllabic words each that conform to the phonemic balance advocated by Lehiste and Peterson. The lists were given twice to three different groups of 16 subjects—those with normal hearing, those with conductive losses, and those with sensorineural losses. During each test, six presentation levels of ascending intensities were used, the total range being from -4 db. to +40 db. sensation level. The three types of subjects evidenced articulation functions of the same shape, but the functions for sensorineurals were of gentler slope than for the other two groups. The discrimination scores for List I were slightly higher than for List II. During the retest, the discrimination scores improved slightly. Scores between lists as well as those from test to retest showed relatively high positive correlation. Therefore, the N. U. Auditory Test No. 4 seems to be a valuable tool for the measurement of phonemic discrimination. (Authors' abstract)

g. Sanitation and Hygiene (Exclusive of cabins, for which see 11-e)

1997
Baumgartner, D. J.
WATER SUPPLY AND WASTE DISPOSAL PROBLEMS AT REMOTE AIR FORCE SITES IN ALASKA.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8246-1). Technical Note no. AAL-TN-62-1, March 1963, 6 p.

A review of some of the water supply and waste disposal problems at remote Air Force sites is presented. Some of these problems directly affect health and well-being. Others concern unesthetic conditions and lack of convenience, and although less critical, they still influence man's ability to function effectively in cold environments. Specific problems and their solutions are discussed and illustrated. Examples include: (1) color removal—the color removal facility at the Middleton Island water supply and its application to the other sites; (2) iron removal—progress in the design of a compact and simple iron-removal facility for use at remote sites; (3) disposal of waste in areas where water is not readily available—the aerobic recirculating waste-treatment system for conservation of water and disposal of wastes; and (4) oil carriage-sewage incineration method of waste disposal used at Pt. Barrow. Problems which remain to be solved are evaluated. (Author's abstract)

1998
Donovan, M. C.
PROBLEMS IN AIRPORT SANITATION. —— Jour. Milk and Food Technol., 25 (11): 345-351. Nov. 1962.

Various areas of sanitation incorporated in the Miami International Airport Terminal program are discussed. These include: (a) catering point sanitation, (b) airline servicing areas, (c) aircraft sanitation, (d) industrial waste disposal, (e) industrial hygiene, (f) insect and rodent control, and (g) terminal sanitation. It is indicated that airports vary in type, size, and operation and that an airport sanitation program is influenced by such factors as location and climatic conditions.

1999
McCall, C. M.,
L. Szmyd, B. O. Hartman, B. E. Welch, and R. E. McKenzie
A METHOD FOR SELECTING AN ORAL HYGIENE TECHNIC FOR USE IN SPACE CABIN SIMULATOR FLIGHTS.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 775602). Technical Documentary Report no. SAM-TDR-62-110, Jan. 1963. iii+8 p.

Five oral hygiene technics were evaluated for use in the United States Air Force space-cabin simulator and, ultimately, in actual space missions. The control technic consisted of the use of toothbrush, dentifrice, dental floss, and water rinse. The oral hygiene methods evaluated were: (1) chewing gum only; (2) toothbrush only; (3) toothbrush and dental floss; and (4) toothbrush and water rinse. Each method was tested for ten days. By use of both objective and subjective measurements, the toothbrush and dental floss method was proved to be as effective as the accepted use of toothbrush, dentifrice, dental floss, and water rinse in maintaining good oral hygiene. The degree to which good oral hygiene is maintained depends on the individual. (Authors' abstract)

2000
Rainwater, H. I.
AGRICULTURAL INSECT PEST HITCHHIKERS ON AIRCRAFT.—Proc. Hawaiian Entomological Soc., 18 (2): 303-309. July 1963.

Statistical data are presented showing the frequency of various agricultural pests (Diptera, Lepidoptera, Coleoptera, etc.) found on aircraft entering the continental United States and Hawaii from worldwide origins. The number of insects found is small compared to the total number of arriving planes, and of this number very few are agricultural pests. A list of precautions is given for use in controlling pests arriving by aircraft, and it is thought that if these precautions are followed, the chance of introduction of insect pests will be small.

2001
Walters, C. F.,
and D. J. Baumgartner
WASTE DISPOSAL SYSTEM FOR SMALL GROUPS AT REMOTE USAF SITES IN THE ARCTIC.—Department of Health, Education, and Welfare. Arctic Health Research Center, Anchorage, Alaska (Cross Service Agreement CSA 61-1); issued by

Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8246-1). Technical Documentary Report no. AAL-TDR-62-46, April 1963. iii+7 p.

A waste disposal system for two people incorporating a marine toilet, chlorinator, and storage tank was designed and investigated by the Arctic Health Research Center to provide a recirculating liquid for toilet flushing, thus eliminating the need for fresh water. The system is not intended to allow biological or chemical breakdown of the organic waste, but merely to provide an acceptable method of waste storage. Ultimate disposal is required. It is anticipated that this system will provide a method of waste disposal for small groups of men assigned to remote radar sites in Alaska. The experimental unit proved acceptable for a two-member household for a trial period of five months. The system possesses the following characteristics: (1) minimum water use, (2) minimum energy use, (3) not subject to or rendered unusable by freezing, (4) minimum problem of ultimate disposal, (5) minimum odors, (6) minimum maintenance, and (7) conventional toilet. (Authors' abstract)

2002
Wannenmacher, E. P.
[STOMATOLOGICAL SERVICE IN THE SWISS AIR FORCE: ORGANIZATION AND IMPORTANCE, PROBLEMS AND RESULTS] Le service stomatologique dans l'aviation militaire suisse: organisation et importance, problèmes et résultats.—Revue de médecine aéronautique (Paris), 1 (3): 32-33. March-April 1962. In French.

The stomatological service is charged with the task of examining the teeth and maintaining proper dental hygiene in flying personnel. During induction medical examination, each candidate is subjected to a clinical and radiological examination of the mouth. Odontological standards for selection of flight candidates are very strict. Throughout their career flying personnel are under the regular control of the stomatological service. Aerodontalgia, a great problem in aviation medicine, can occur accidentally or be induced experimentally in a decompression chamber. Pain may be so great that the pilot becomes incapable of performing his flight mission. The aeronautical conditions for its appearance are: changes in atmospheric pressure, centrifugal forces during agitated flight, temperature variations, violent air currents, oxygen inhalation, mastication and excessive occlusion pressures, vibrations, fatigue, and functional disorders of the body during flight. Many cases of dental focal infections diagnosed and treated by the stomatological service resulted in improvements of various other conditions such as general functional disorders, nephritis, skin or allergic inflammations, etc.

h. Public Health Aspects

2003
Lafontaine, E.,
and R. Laplane
[AERIAL VOYAGES AND VACCINATIONS] Voyages aériens et vaccinations.—Presse médicale (Paris), 70 (19): 961-962. April 21, 1962. In French.

A review is presented of national and international regulations concerning quarantinable diseases (plague, variola, cholera, yellow fever, typhus, recurrent fever) and obligatory vaccinations. Also discussed are vaccination certificates, exemption from vaccinations, and vaccination centers in France. Responsibilities of the airlines in the matter of passenger vaccination are emphasized.

9. TOXICOLOGY

a. General

2004
Arena, J. M.
POISONING: CHEMISTRY, SYMPTOMS, TREATMENTS.—xvii+440 p. Springfield, Illinois: Charles C Thomas, 1963.

This book contains chapters dealing with the general aspects of poisoning, public safety education, and poisoning caused by such items as insecticides, rodenticides, fungicides, drugs, soaps, cosmetics, poisonous plants, etc. Of special interest is Chapter 4 (p. 99-138) which is concerned with the chemistry, symptoms, and treatment of industrial compounds such as halogenated hydrocarbons, carbon dioxide, carbon monoxide, benzene, sulfur dioxide, gasoline vapor, etc. Chapter 5 (p. 139-175) comprises an extensive table listing the occupations, hazards, diagnosis. Also considered in the book is toxicity resulting from propane (p. 313), and rocket fuels (p. 316).

2005
Bovee, H. H.,
and J. E. Schubert
PROTECTION AGAINST TOXIC SUBSTANCES IN SPACE TRAVEL.—Indus. Hygiene Jour., 24 (2): 168-171. March-April 1963

Of the many sources of toxic contaminants in the space cabin atmosphere, thermal decomposition products from elastomers, plastics and other compounds are the most hazardous. A study of the decomposition characteristics and toxicity of several of these materials indicates that the smoke and fumes given off contribute significantly to the toxicity predicted on the basis of gaseous decomposition products only. Removal of normal air contaminants is within the present state-of-the-art capability but protection against thermal decomposition products caused by fire may not be economically feasible except by depressurization and atmosphere replacement. (Authors' abstract)

2006
Curry, A. S.
POISON DETECTION IN HUMAN ORGANS.—xxi+150 p. Springfield, Illinois: Charles C Thomas, 1963.

This is a laboratory guide for the detection of poisons in human organs with discussions of the principles on which the methods are based. Analysis of samples from the living or dead is considered within the framework of the organs on which they are performed to ensure that each poison is sought in the particular tissue it is most likely to concentrate. Chapters deal with general considerations in toxicology, analyses of blood, urine, alimentary tract, liver, brain, kidney, and other poisons, and histochemical and biological investigations. Of special interest are analyses for carbon monoxide, metals, volatile poisons, benzene, alcohols and aldehydes. Included are various tables and a subject index.

2007
Domanski, J.,
A. M. Dominguez, L. R. Goldbaum, and F. M. Townsend
AEROSPACE TOXICOLOGY: PAST, PRESENT, AND FUTURE.—Military Medicine, 128 (8): 717-725. Aug. 1963.

Since 1956, the Armed Forces Institute of Pathology has provided a program of pathologic and toxicologic support in the medical investigation of aircraft accidents. The toxicological Branch has developed and applied the following methods for determining causative factors in aircraft accidents: post-mortem analysis of carbon monoxide by gas-solid chromatography, evidence of drowing by utilizing the presence of diatoms isolated from lung and other tissues, test for the presence of alcohol with highly sensitive gas chromatography, determination of drugs (tranquilizers, antihistaminics, alkaloids, motion sickness drugs) in body tissues using iontophoresis or gas and thin-layer chromatography, and determination of ante-mortem hypoxia on the basis of post-mortem brain lactic acid values. Current concepts and research at the Institute relative to the application of toxicology to the solution of both present and emergent aerospace problems are discussed.

2008
Semenenko, A. D.
[USE OF FUNCTIONAL ELECTROENCEPHALOGRAPHY IN THE STUDY OF EFFECTS OF UNDETECTABLE CONCENTRATIONS OF AIR POLLUTANTS UPON THE HUMAN ORGANISM] Primenenie funktsional'noi elektroencefalografii pri izuchenii deistviia neoshchutimykh kontsentratsii atmosfernykh zagriaznenii na organizm cheloveka.—Gigiena i sanitariia (Moskva), 28 (7): 49-55. July 1963. In Russian.

Subjects were exposed to flickering light signals (10 msec., 8 c.p.s.) for 9 minutes. Electroencephalograms (EEG) were taken with various leads, and the sum total of the amplitudes of all waves was determined. Subsequent exposure of test subjects to vapors of pollutants in concentrations below the olfactory threshold, i.e. methyl methacrylate (0.10 mg./m.^{3}), phenol (0.01 mg./m.^{3}), or acetophenone (0.008 mg./m.^{3}), resulted in changes of the amplitudes of assimilated rhythms; however, only in the case of methyl methacrylate the change was statistically certain.

2009
Shelanski, M. V.,
and K. L. Gabriel
CUTANEOUS TOXICITY EVALUATION OF AIR FORCE DEVELOPMENT MATERIALS. V. — Industrial Biology Research and Testing Labs., Inc., Philadelphia, Pa. (Contract AF 33(616)-7931); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6302, Task no. 630201). Technical Documentary Report no. MRL-TDR-62-26, April 1962. iv+12 p.

Ten Air Force development materials (resins, methyl-cellosolve, bromochloromethane, cutting oil, penetrants, and an emulsifier) were studied via the prophetic patch test method on laboratory animals to determine the primary irritant effect, gross sensitization index, and gross percutaneous toxicity of these materials. The patch test studies with rabbits indicated that none of the materials was a primary irritant, sensitizer, nor gross systemic poison. Therefore, there was no contraindication to proceeding with a Shelanski repeated insult patch test on human volunteers. The results of the human patch test indicated that all of the materials were safe to use in contact with human skin. (Authors' abstract)

2010
THRESHOLD LIMIT VALUES FOR 1962. —— Indus. Hygiene Jour., 23 (5): 419-423. Sept.-Oct. 1962.

Recommended threshold limit values are listed for various substances, including benzene, carbon dioxide, carbon monoxide, gasoline, ozone, and trichloroethylene. These values refer to time-weighted average concentrations for a normal workday and may be used as guides in the control of occupational health hazards. Threshold limits are based on various criteria of toxic effects or on marked discomfort and are not to be used as a common denominator of toxicity, nor as the sole criterion in the diagnosis of suspected occupational disease.

b. Fuels and Lubricants

2011
Andreatch, A. J.
FLAME IONIZATION DETECTOR. —— In: Chemical-toxicological conference. Arch. Environmental Health, 4 (3): 317-319. March 1962.

The high sensitivity of the flame ionization detector and its response based on the carbon content of exhaust gases are discussed. Results of previous air pollution analysis using this method are reviewed, as well as an analysis of automotive exhaust gases. Identified compounds include methane, ethylene, acetylene, butanes, pentanes, butenes, and pentenes. The advantages of this system are compared to those of the infrared hexane analyzer. Olefin analysis is discussed, and the method of using a dual flame unit for olefin analysis is outlined.

2012
Annand, R. R.,
I. Y. Chang, and R. M. Hurd
AN INVESTIGATION OF PHYSICOCHEMICAL METHODS FOR DETECTING TOXIC PROPELLANTS.—TRACOR, Inc., Austin, Tex. (Contract AF 33(657)-8140); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6302, Task no. 630203). Technical Documentary Report no. AMRL-TDR-63-61, June 1963. vi+38 p.

The literature was surveyed for physicochemical measurement techniques used in investigating phenomena in surface adsorption, corrosion, and dielectric and electromagnetic effects. Fourteen specific types of measurements were found that have potential merit for detection of toxic concentrations of propellants. Of these techniques, surface conductivity of semiconductors, ionization by radio-frequency excited helium, and halogen enhanced flame ionization were studied experimentally for ability to detect p.p.m. levels of lithium salts, beryllium salts, hydrazine and its derivatives, hydrogen chloride, hydrogen, chlorine, and oxides of nitrogen, in ambient air. Best general results were obtained with the surface conductivity detector, in that detection at low levels was observed for the largest number of compounds in the subject group. Sufficient sensitivity for lithium salts is readily obtained by flame ionization. High sensitivity for UDMH was obtained through ionization by rf excited helium. All of these techniques are adaptable to portable instrumentation. (From the authors' abstract) (27 references)

2013
Back, K. C.,
M. K. Pinkerton, A. B. Cooper, and A. T. Thomas
ABSORPTION, DISTRIBUTION AND EXCRETION OF 1,1-DIMETHYLHYDRAZINE (UDMH). —— Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6302, Task no. 630202). Technical Documentary Report no. MRL-TDR-62-30, May 1962. iii+13 p.
Also published in: Toxicology and Applied Pharmacology, 5 (4): 401-413. July 1963.

The absorption, distribution, and excretion of 1,1-dimethylhydrazine (UDMH) were studied in rats, rabbits, cats, dogs, and monkeys by use of C^{14}-tracer and colorimetric methods. UDMH was rapidly absorbed into the blood regardless of route of administration and was also quite rapidly excreted by the kidneys as evidenced by early high concentrations in both blood and urine. Simultaneous tracer and colorimetric studies indicated that 30-50% of the compound was excreted in its unchanged form in the urine of hydrated cats and dogs in 5 hours. Tracer experiments showed that UDMH was not preferentially concentrated in the vital organs of the body. Peak concentrations of UDMH in blood were found in 15-60 minutes after injection. The compound was not detectable in the blood of any species after doses of less than 10 mg./kg. Wide variations in individual levels of UDMH in blood with respect to dose and time made it extremely difficult to predict accurately the extent of exposure by examination of blood concentration. The most sensitive indication of exposure to UDMH was the presence of the compound in the urine. Urinary concentrations were found at dose levels which did not produce detectable blood concentrations. The relationships of UDMH blood and urine levels and their correlations with symptomatology are discussed. (Authors' summary)

2014
Back, K. C.,
and A. A. Thomas
PHARMACOLOGY AND TOXICOLOGY OF 1,1-DIMETHYLHYDRAZINE (UDMH). —— Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6302, Task no.

630202). Technical Documentary Report no. AMRL-TDR-62-118, Oct. 1962. iii+8 p.

The acute LD_{50} of UDMH in mice, rats, dogs, and monkeys by intraperitoneal administration was found to be 125 mg./kg., 104 mg./kg., 60-100 mg./kg., and 60-100 mg./kg., respectively. All animals exhibited clonic-tonic convulsions as the predominant symptom, and death was via respiratory arrest. Dogs and monkeys routinely showed emesis within 15-60 minutes following dose of UDMH, regardless of route. In the anesthetized dog UDMH did not alter the effects of epinephrine, norepinephrine, acetylcholine, histamine, or reserpine on blood pressure. It did not significantly affect autonomic ganglia or postganglionic nerve endings, nor did it markedly alter the electrocardiogram or blood pressure in 1-2 hours. In the unanesthetized dog, however, blood pressure was significantly increased until convulsions and respiratory arrest occurred. (Authors' abstract)

2015
Cordasco, E. M.,
C. Anderson, R. Cooper, C. Masur, and J. Murphy
INHALATION THERAPY IN ROCKET FUEL INTOXICATION. — Inhalation Therapy, 8 (1): 11-15. Feb. 1963.

A study was made of inhalation therapy in 35 patients suffering from different stages of intoxication by the rocket fuels diborane, decaborane, or pentaborane. Symptoms and effects of acute or chronic poisoning are reported, and the results of oxygen inhalation are presented in two case histories of diborane intoxication.

2016
Cordasco, E. M.,
R. W. Cooper, J. V. Murphy, and C. Anderson
PULMONARY ASPECTS OF SOME TOXIC EXPERIMENTAL SPACE FUELS. — Diseases of the Chest, 41 (1): 68-74. Jan. 1962.

Pulmonary symptoms were found in workers exposed to boranes (combinations of boron and hydrogen which serve as intermediary agents in the formation of high-energy space fuels). Acute diborane intoxication is associated predominantly with bronchopulmonary involvement, whereas acute decaborane and pentaborane toxicity is manifested primarily by neurologic abnormalities. Two cases of acute diborane intoxication with pneumonitis were encountered. Chronic respiratory distress was present in two patients from recurrent diborane exposure and in one patient from combined triple borane exposures. This chronic disability is probably on a hypersensitivity basis and appears clinically as an asthmatic bronchitis. (Authors' summary and conclusions, modified)

2017
Delgado, J. M. R.
EFFECTS OF DECABORANE ON BRAIN ACTIVITY.—Yale Univ. School of Medicine, New Haven, Conn. (Contract AF 33(657)-9021); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6302, Task no. 630202). Technical Documentary Report no. AMRL-TDR-63-41, May 1963. iii+19 p.

The effects of intraperitoneal injection of decaborane was investigated in monkeys with electrodes permanently implanted in the brain. One single injection of 5 mg./kg. produced a marked behavioral depression, with only moderate electroencephalographic modifications, followed by death in 18 hours. Four daily doses of 3 mg./kg. produced depression, somnolence, twitching in both arms, accompanied by bursts of high-voltage activity localized in the internal capsule. Death occurred 3 days later. Daily doses of 1 mg./kg. up to a total of 14 mg./kg. produced depression, muscular twitching, anorexia, and a typical electroencephalographic pattern, but the animals recovered completely. Depression may be related to reticular system involvement. Motor symptomatology could depend on disturbances of heavily myelinated motor axons which may have a special affinity for the liposoluble decaborane. Hypothalamic involvement was questionable, but neighboring structures, especially the internal capsule, showed electrical disturbances. (Author's abstract)

2018
Heck, W. W.,
L. S. Bird, M. E. Bloodworth, W. J. Clark,
D. R. Darling, and M. B. Porter
ENVIRONMENTAL POLLUTION BY MISSILE PROPELLANTS. — Texas A. and M. Research Foundation, College Station, Texas (Contract AF 33(616)-7801); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6302, Task no. 630204). Technical Documentary Report no. MRL-TDR-62-38, April 1962. viii+112 p.

The effects of 21 missile fuel components, in concentrations of 0, 1, 10, 100, and 1000 parts per million, were determined on aquatic organisms (goldfish and Daphnia), soil microflora (bacteria, actinomycetes, and fungi), plants (squash, soybean, cowpea, and corn) and soils (leachability, runoff, and structure). Some or all of the aquatic organisms died when exposed to 100 p.p.m. of the test chemicals. The same concentration of chemicals had no effect on the counts of soil microflora. Three of the test samples may sterilize the soil of actinomycetes. A concentration of 1000 p.p.m. of two of the compounds and two ionic species produced inhibition of seedling germination. Three of the ionic components, when used as a soil drench at 100 p.p.m., produced toxic symptoms. When three of the test chemicals (gases) were used at 100 p.p.m. as air pollutants, severe injury or death occurred in all species. Soil analyses were erratic and indicated further research on this problem. Future studies should include the concentration-time relationship of the toxic materials and the absorptive capacities of soil fractions for the test compounds. (Authors' abstract) (44 references)

2019
Kehoe, R. A.,
J. Cholak, J. A. Spence, and W. Hancock
POTENTIAL HAZARD OF EXPOSURE TO LEAD. I. HANDLING AND USE OF GASOLINE CONTAINING TETRAMETHYLLEAD.—Arch. Environmental Health, 6 (2): 239-254. Feb. 1963.

Clinical records of employees of garages handling and using gasoline containing tetramethyllead were examined during three periods (Part I, usual garage conditions; Part II, using a fuel containing 3 ml. of tetraethyllead per gallon; Part III, using an equivalent quantity of tetramethyllead substituted for tetraethyllead). Analysis of the air in the garage to measure the potential occupational exposure to lead therein, demonstrated that the respiratory exposure of the workmen almost doubled during Part II and nearly quadrupled during Part III. No evidence was found of any increase in the absorption of lead by the men. No significant changes were found in the lead concentration in the urine or blood of the workers during the period of observation. In view of the negative outcome of the investigation, regarding the potential hazard due to the absorption of lead in association with the use of tetramethyllead, there appears to be no hygienic reason against its use.

2020
Kehoe, R. A.,
J. Cholak, J. G. McIlhinney, G. A. Lofquist, and T. D. Sterling
POTENTIAL HAZARD OF EXPOSURE TO LEAD. II. FURTHER INVESTIGATIONS IN THE PREPARATION, HANDLING, AND USE OF GASOLINE CONTAINING TETRAMETHYLLEAD.—Arch. Environmental Health, 6 (2): 255-272. Feb. 1963.

The results of the investigation of the potential hazard of the absorption of lead, in association with the industrial and commercial activities involved in the handling of an antiknock compound containing tetramethyllead in a petroleum refinery, and with the distribution of gasoline containing this compound of lead, as carried out over a period approximating 16 months, are summarized. These results demonstrate that the exposure of the various groups of workmen to tetramethyllead, under the prevalent environmental conditions of their occupations, is negligible. (Authors' conclusion)

2021
Kennebeck, M.,
R. Wetherington, D. A. Nole, H. Roby, and M. Y. Longley
TOXIC HAZARDS EVALUATION OF TITAN II TEST FIRINGS: METHODS AND RESULTS OF LABORATORY AND FIELD INVESTIGATIONS.—Aerojet-General Corp., Azusa, Calif. (Contract AF 33(616)-7836); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6302, Task no. 630205). Technical Documentary Report no. AMRL-TDR-63-52, June 1963. viii+70 p.

Toxicologically significant environmental contaminants near Titan II test-stand facilities were studied, with specially developed field and laboratory techniques, primarily to determine the degree of hazard associated with exhaust constituents. For exhaust products that were identified and quantitatively evaluated, it was found that normal test firings create no significant personnel hazard in test areas and that, with proper treatment procedures, no significant water-pollution problems are created. A method for determining Titan II test-firing contributions to a community-air-pollution situation was also developed. This study emphasizes the need for investigation of more refined atmosphere analysis technique and instruments to determine trace contaminants resulting from static and dynamic missile firings. Detailed analytical methods for field samples containing unsymmetrical dimethylhydrazine, hydrazine, and nitrogen dioxide are presented. (Authors' abstract)

2022
Kiebel, J.,
H. L. Gant, S. O. Schwartz, and I. A. Friedman
BONE MARROW DEPRESSION FOLLOWING EXPOSURE TO KEROSENE: A REPORT OF 3 CASES. — Amer. Jour. Med. Sci., 246 (2): 185-191. Aug. 1963.

Three cases of bone marrow suppression associated with cutaneous and oral exposure to kerosene are presented. Published reports are reviewed in terms of pharmacology and attributed causation. A possible mechanism is postulated. Kerosene is an excellent fat solvent and thus can penetrate the heavy fat content of marrow. The aromatic impurities of kerosene may or may not be contributory in the suppression of the bone marrow. Further animal studies are required. Discontinuance of exposure is mandatory. (Authors' summary)

2023
Kooiker, R. H.,
L. M. Schuman, and Y.-K. Chan
NITROGEN DIOXIDE POISONING. I. OCCUPATIONAL SIGNIFICANCE AND EVALUATION OF TOXICOLOGIC DATA AND EXPERIMENTAL METHODOLOGY. II. A NEW APPROACH TO EXPERIMENTAL EXPOSURE STUDIES: METHODOLOGY USING A STATIC SYSTEM, WITH STATISTICAL EVALUATION OF FACTOR VARIABILITY. —Archives Environmental Health, 7 (1): 13-32. July 1963.

Occupational hazards from exposure to nitrogen dioxide have become increasingly significant with advances in space age technology. For example, military silos housing rockets which use nitric acid as a fuel oxidant constitute a hazard to military personnel. A review of the literature reveals inadequate data concerning the hazard of such poisoning. Experimental studies are numerous, but the data are conflicting and comparison of results is difficult. In a new approach to experimental exposure studies, a static type chamber of relatively small size, which is described and diagrammed, has been developed which features rapid and safe introduction and removal of animals, standardization of animal activity, and accurate maintenance of test substance concentration. A modified chemical method is used to determine the concentration of nitrogen dioxide in permanently trapped atmospheric samples. Data obtained from animal exposure experiments performed with this method are subjected to statistical analysis. (77 references)

2024
Markićević, A.,
and T. Beritić
[FOUR CASES OF LEAD TETRAETHYL POISONING] Četiri slučaja otrovanja olovnim tetraetilom.—Arhiv za higijenu rada i toksikologiju (Zagreb), 13 (4): 311-317. 1962. In Serbo-Croatian, with English summary (p. 317).

Four cases of light lead tetraethyl poisoning are described. Of these three were acute and the fourth was chronic. The acute cases developed upon cleansing of a tank of ethylated gasoline in an oil refinery. The chronic case developed during the filling and emptying of a tank over a period of time. Literature data are reviewed. (Authors' summary, modified) (34 references)

2025
Nice, W.
INDUSTRIAL POISONS: TOXIC REACTION FOLLOWING INHALATION OF FUMES OF RP-I MISSILE FLUID.—Jour. Kansas Med. Soc., 64 (5): 217-218. May 1963.

This is the first case reported of a patient with a severe toxic disease following inhalation of fumes of RP-I missile fluid. He developed myocardial anoxia, marked decrease in renal function, pulmonary fibrosis, decreased platelet count, methemoglobinemia, and +3 cephalin flocculation.

2026
Pinkerton, M. K.,
J. M. Lauer, P. Diamond, and A. A. Tamas
A COLORIMETRIC DETERMINATION FOR 1,1-DIMETHYLHYDRAZINE (UDMH) IN AIR, BLOOD AND WATER.—Indus. Hygiene Jour., 24 (3): 239-244. May-June 1963

A simple, rapid colorimetric procedure is described for measuring microgram quantities of 1,1-dimethylhydrazine (UDMH) in blood and water. The method, with minor modification, has also been adapted for analysis of air samples. The report provides a calibrated range for analysis of 1-60 micrograms UDMH per milliliter fluid and of 2.5-50 parts per million in air; its useful range may be considerably extended by manipulative dilution techniques. The test has additional, limited qualitative application to the analysis of urine. (Authors' abstract)

2027
Roush, G.,
B. M. Kent, and H. A. Volz
RESEARCH ON TOXIC HAZARDS OF PENTABORANE. — Callery Chemical Co., Callery, Pa. (Contract AF 33(616)-7728); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6302, Task no. 630205). Technical Documentary Report no. AMRL-TDR-62-109, Sept. 1962. v+37 p.

At a plant producing pentaborane, sixty workers were potentially exposed to the boranes. The purpose of this investigation was to measure these workers' exposure with the Blood Borane Test of Miller, to measure the contamination of the workers' environment, and to relate the data to observed biologic effects in the workers. The atmospheric monitoring revealed that the work area was usually not contaminated. Thirty-one cases of possible borane poisoning were seen. The Blood Borane Test was negative in each of these cases but these results may be due to the mild nature of the poisonings. The lung, liver, and kidney studies used revealed no abnormalities in these cases. A clinical evaluation on all of the exposed workers at the end of a year's production revealed no observable effects. The protective gear worn provided good, though not complete, protection. Further study of the hazards of the boranes will require a monitoring instrument of wider range of sensitivity to evaluate the acute poisonings and the protective gear worn. (Authors' abstract)

2028
Weeks, M. H.,
G. C. Maxey, M. E. Sicks, and E. A. Greene
VAPOR TOXICITY OF UDMH IN RATS AND DOGS FROM SHORT EXPOSURES.—Indus. Hygiene Jour., 24 (2): 137-143. March-April 1963.

The use of 1,1-dimethylhydrazine (UDMH, Dimazine) as a storable liquid fuel in advanced missile systems has resulted in the need for additional information on the health hazards from short exposures to this compound. A study was made of the inhalation toxicity of UDMH in animals from single short exposures. Five- to sixty-minute exposure of dogs and rats to high concentrations of UDMH produced toxic signs similar to those resulting from longer inhalation exposures. No clinical abnormalities resulted from these single short-term exposures. Dogs exposed to 50, 200, and 600 parts per million of UDMH for single or multiple periods of 60-, 15-, and 5-minute duration, respectively, showed no adverse physiological effects. These levels of UDMH can serve as a basis from which short-term exposure standards may be estimated for man. Dogs retained about 80% of the inhaled UDMH. (Authors' abstract, modified)

2029
Weir, F. W.,
V. M. Seabaugh, M. E. House, D. G. Burke, and M. H. Weeks
FURTHER STUDIES ON THE SHORT-EXPOSURE INHALATION TOXICITY OF PENTABORANE IN DOGS.—Army Chemical Research and Development Labs., Edgewood Arsenal, Md. (MIPR (33-616)-61-34); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6302, Task no. 630201). Technical Documentary Report no. AMRL-TRD-63-47), June 1963. iii+15 p.

Studies are reported on the responses of dogs to pentaborane (B_5H_9) vapor from multiple short inhalation exposures and from cutaneous exposures. Dogs exposed daily at 1.0 and 6.1 p.p.m. of B_5H_9 for 60- and 5-minute periods, respectively, showed increases in response time in a conditioned avoidance response test after the 3rd and 4th exposures, and a refusal to perform after the 6th and 7th exposures. An accumulation of toxic effects was seen in groups of dogs exposed for 1 hour to 2.5 p.p.m. of B_5H_9 with rest intervals of 24, 48, 72, or 96 hours between re-exposures. Two daily exposures caused severe signs of toxicity. Increasing the exposure interval from 24 to 96 hours delayed the onset of signs. Dogs exposed cutaneously for single 2-, 4-, and 6-hour periods to 580, 550, and 710 p.p.m. of B_5H_9, respectively, showed minimal or no signs of toxicity. (Authors' abstract)

c. Paints, Solvents, etc.

2030
Katsunuma, H.,
and A. Koizumi
A CONTRIBUTION TO THE KNOWLEDGE OF NORMAL VARIATION IN TOTAL LEUCOCYTE COUNT. — Japanese Jour. Physiol., 12 (3): 251-256. June 1962.

Individual differences in total leucocyte counts were analyzed in twelve normal adult males and industrial workers exposed to hazardous organic solvents (benzene, toluene, etc.). A marked individual difference was determined in the total leucocyte count, and each individual showed his own pattern of variation. The difficulty is emphasized of discrimination of normality from an isolated observation. (Authors' summary, modified)

d. Organic and Technological Waste Products (Including CO and CO_2)

2031
Anderton, J. L.,
and E. A. Harris
THE CHANGING STATE OF BREATHING DURING INHALATION OF CO_2 STUDIED WITH AN INEXPENSIVE RECORDING CO_2-ANALYZER. — Quart. Jour. Exper. Physiol. (Edinburgh), 48 (1): 1-12. Jan. 1963.

A method is described for recording alveolar CO_2 tension using simple and inexpensive apparatus. The changing state of hyperventilation due to CO_2 has been studied and a procedure devised for deriving the steady-state CO_2-response line from data obtained during the changing state. This procedure has considerable practical advantages over conventional methods. Evidence is presented to show that the time needed for equilibration of CO_2 between the arterial blood and the cells of the respiratory center is of the order of 4 minutes. (Authors' summary)

2032
Avery, M. E.,
V. Chernick, R. E. Dutton, and S. Permutt
VENTILATORY RESPONSE TO INSPIRED CARBON DIOXIDE IN INFANTS AND ADULTS.—Jour. Applied Physiol., 18 (5): 895-903. Sept. 1963.

A rebreathing method was used to study the increase in ventilation with an increase in alveolar carbon dioxide tension (PA_{CO_2}) in newborn infants and adults. The response curve of infants was shifted to the left of that of adults, which is consistent with their lower initial PA_{CO_2} and buffer base, and greater metabolism per kilogram of body weight. The rebreathing response curves of infants were also to the left of steady-state responses reported by others. It is postulated that nonchemical stimuli caused higher ventilation throughout the entire range of the CO_2 response curves in the infants studied by rebreathing without altering the sensitivity to increases in carbon dioxide tension. The change in ventilation per kilogram versus the change in PA_{CO_2}, the slopes of the carbon dioxide response curves, were nearly the same in infants and adults studied by either method. This finding, when the comparison is made on the basis of body weight, suggests that the sensitivity of the regulatory apparatus does not change with age, and the output of the effector apparatus, lungs and chest wall, is related to the mass of the individual. (Authors' abstract)

2033
Barnett, T. B.,
and R. M. Peters
THE VENTILATORY RESPONSE TO CARBON DIOXIDE AND TO OXYGEN AFTER ACCLIMATIZATION TO CARBON DIOXIDE. — Univ. of North Carolina, Chapel Hill (Contract AF 33(616)-6261); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7163, Task no. 716302). Technical Documentary Report no. AMRL-TDR-62-136, Nov. 1962. iii+14 p.

A chamber has been designed so that dogs can be exposed for prolonged periods to abnormal atmospheres. The concentrations of CO_2 and O_2 are continuously controlled and recorded. Exposure of dogs to approximately 3% CO_2 in air for 6 days or more resulted in a decrease in the ventilatory response to CO_2. In control dogs the breathing of 50% oxygen for 30 minutes was associated with a slight to moderate increase in ventilation without a significant change in arterial CO_2 tension. After acclimatization to CO_2 oxygen breathing was associated with little change in ventilation but with a rise in arterial CO_2 tension. (Authors' abstract)

2034
Bücherl, E. S.,
K. F. Kloos, and J. Wolff
[ELECTRON-MICROSCOPIC FINDINGS IN THE DOG'S LUNG UNDER NORMAL CONDITIONS AND IN EXPERIMENTAL HYPERCAPNIA] Elektronenmikroskopische Befunde an der Hundelunge unter normalen Bedingungen und bei experimenteller Hyperkapnie.—Frankfurter Zeitschrift für Pathologie (Berlin), 72 (2): 167-178. 1962. In German.

Electron-microscopic investigations were undertaken on the lungs of three dogs before and during a short period of severe hypercapnia (P_{CO_2} 500 mm. Hg in the arterial blood) without hypoxemia. There were no changes of the alveolar membranes. A large number of the capillaries were distended; all erythrocytes observed were enlarged. Occasionally an increase of plasma density was observed. (45 references)

2035
Chapin, J. L.,
and J. L. R. Edgar
COOLING OF RATS IN CARBON DIOXIDE. — Amer. Jour. Physiol., 204 (4): 723-726. April 1963.

Rats cool in high carbon dioxide at room temperatures from 12° to 41° C. Confinement plays only a small role in this cooling. The mechanisms for cooling appear to be: (1) lowered metabolic rate, (2) lack of shivering, and (3) hyperventilation. High carbon dioxide administration is accompanied by intense peripheral vasoconstriction which, when room temperatures are higher than body temperatures, aids cooling. (Authors' abstract)

2036
Clancy, R. L.,
and E. B. Brown
CHANGES IN BONE POTASSIUM IN RESPONSE TO HYPERCAPNIA.—Amer. Jour. of Physiol., 204 (5): 757-760. May 1963.

Rats that breathed 30% carbon dioxide (CO_2) for four hours did not show a statistically significant change in the concentration of potassium in compact bone. Four hours of breathing 30% CO_2 in dogs and 48 hours of 15% CO_2 in rats, however, resulted in an increase in bone potassium. Changes in potassium in bone and interstitial fluid were in the same direction but the magnitude of change in interstitial fluid was not sufficient to account for the change in bone. All of the experiments indicate that bone does not contribute to the hyperkalemia associated with respiratory acidosis since bone apparently takes up potassium which is being transferred to the extracellular fluid from other sources. (From the authors' abstract)

2037
Dominguez, A. M.
SYMPOSIUM—FIRE AND INCENDIARISM: PROBLEMS OF CARBON MONOXIDE IN FIRES.—Jour. Forensic Sciences, 7 (4): 379-392. Oct. 1962.

A discussion is presented of the physiologic response to carbon monoxide produced in conflagrations, along with the effects produced on an individual exposed to fire, collection of suitable material for laboratory examination, problems associated with the interpretation of the resultant laboratory data, and circumstances which do or might affect the character of the analytical findings. In cases with relatively low levels of carbon monoxide, the laboratory studies must be complemented by a thorough autopsy in which particular attention is directed to air passages. Related additional data are presented which are based upon the results of carbon monoxide studies at the Armed Forces Institute of Pathology.

2038
Fuleihan, F. J. D.,
T. Nakada, J. T. Suero, E. S. Merrifield, R. E. Dutton, S. Permutt, and R. L. Riley
TRANSIENT RESPONSES TO CO_2 BREATHING OF HUMAN SUBJECTS AWAKE AND ASLEEP. — Jour. Applied Physiol., 18 (2): 289-294. March 1963.

Ventilation and end-tidal carbon dioxide tension (P_{co_2}) were studied in six subjects awake and asleep (following the ingestion of 200-300 mg. sodium pentobarbital) during oxygen breathing and the administration and withdrawal of 4% CO_2 in oxygen. During the control period as well as steady-state CO_2 breathing, ventilation was significantly lower in asleep than in awake subjects. There was no significant difference between sleep and wakefulness in end-tidal P_{co_2} or in the slope of the ventilatory response to 4% CO_2. The transient responses of ventilation and end-tidal Pco of the group as a whole were similar in sleep and wakefulness. Ventilation changed more slowly than did end-tidal P_{co_2}. End-tidal P_{co_2} overshot beyond the steady-state CO_2 breathing value at the onset of CO_2 breathing; and undershot below the control value during recovery. The magnitudes of both the overshoot and undershoot of end-tidal P_{co_2} were correlated significantly to the slope of the ventilatory response to 4% CO_2, in the whole group awake and asleep. (Authors' abstract)

2039
Gillen, H. W.
THE DEVELOPMENT OF TOLERANCE TO CARBON DIOXIDE [Abstract].—Electroencephalography and Clinical Neurophysiol. (Amsterdam), 15 (1): 154. Feb. 1963.

Male Sprague-Dawley rats were exposed to gas mixtures of CO_2 and O_2 in a sudden fashion. The EKG and EEG were recorded through chronically embedded electrodes. Approximately 50% of the tests resulted in a seizure after 4-5 min. of the first exposure if the partial pressure of CO_2 was between 225 and 300 mm. Hg. This is the induction seizure of hypercarbia. If the exposure was terminated abruptly after more than 5 minutes, all of the animals had tonic, clonic seizures within 1-2 min. which were repeated often up to 10 min. of the recovery period. These are termed withdrawal seizures. After repeated 15 minute exposures on consecutive days the animals did not develop induction seizures after the second exposure, indicating a tolerance to the induction challenge of hypercarbia, however, the withdrawal seizures remained unaffected. Change in respiratory rates also suggest decreasing induction challenge from CO_2 exposure. Brain and plasma biochemical studies after the exposure revealed no significant alteration during the test series. These observations suggest that even a 15-min. exposure to hypercarbia once a day is not completely reversed within 24 hours. The total challenge from the 15 minute exposure itself apparently remains unaltered as indicated by the unchanged withdrawal seizure incidence. The mechanism responsible for the changes observed and the development of tolerance are as yet unknown. (Quoted in part)

2040
Hofreuter, D. H.,
E. J. Catcott, and C. Xintaras
CARBOXYHEMOGLOBIN IN MEN EXPOSED TO CARBON MONOXIDE. — Arch. Environmental Health, 4 (1): 81-85. Jan. 1962.

The average blood carboxyhemoglobin (COHb) level for 68 subjects exposed daily to carbon monoxide in their daily working environment was significantly higher than the comparison group's average at the 1% level. The factor of age, length of occupational exposure, and commuting to work in a private automobile showed no significant effect on COHb levels. Fifty-four of the exposed subjects were smokers and exhibited a mean COHb level of 3.8%, and nonsmokers 3.4%. Mean COHb level of smokers in the comparison group was 2.9% and of nonsmokers 1.9%. No relationship was found between COHb levels and symptoms associated with carbon monoxide intoxication.

2041
Kiriushina, I. N.
[THE EFFECT OF HYPERCAPNIA ON CARDIAC BLOOD SUPPLY] Vliianie giperkapnii na krovosnabzhenie serdtsa.—Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 55 (4): 9-14. April 1963. In Russian, with English summary (p. 14).

Experiments were conducted on dogs under morphine-urethane anesthesia. The thermoelectric method was used for studying the volume rate of coronary circulation. Respiration, blood pressure, and electrocardiogram were recorded simultaneously. 3, 5, 7, 10, 15, 20 and 30 per cent CO_2 concentrations were used in the air with the addition of oxygen to the gas mixture. The exposure time varied from 30 seconds to one hour. In the majority of cases the reaction of the coronary circulation was biphasic: a reduction at the beginning of the action (the 1st phase) and an increase at the end (the 2nd phase). With the CO_2 concentration and mixture held constant, the manifestation of the second phase depended on the duration of exposure (not less than 3 minutes). Comparison of the curves of the blood pressure and coronary circulation leads to the conclusion that there is a constriction of coronary blood vessels during the first and a dilatation during the second phase. (Author's summary, modified)

2042
Lade, R. I.,
and E. B. Brown
MOVEMENT OF POTASSIUM BETWEEN MUSCLE AND BLOOD IN RESPONSE TO RESPIRATORY ACIDOSIS. —— Amer. Jour. Physiol., 204 (5): 761-764. May 1963.

Experiments were performed on anesthetized dogs in order to study (1) the movement of potassium between the gastrocnemius muscle and blood during and following two hours of respiratory acidosis produced by breathing 30% CO_2 in O_2, and (2) the differences between skeletal and cardiac muscle with respect to potassium movement during the first 10 minutes of breathing CO_2 and after return to air breathing. It was found that skeletal muscle lost potassium during hypercapnia. The loss was evident much earlier and was greater if the muscle was stimulated to intermittent contraction than if it was resting. The heart began to gain potassium a few minutes after CO_2 breathing began and lost potassium shortly after return to air breathing following 11 minutes of hypercapnia. There was no evidence for a contribution of skeletal muscle to the high transient elevation of the arterial potassium concentrations in the early posthypercapnic period. (From the authors' abstract)

2043
Leoni, M.,
and C. G. Kwilecki
[EFFECT OF HYPERVENTILATION CAUSED BY CARBON DIOXIDE ON THE INTERNAL TEMPERATURE OF THE RABBIT] Influenza dell'iperventilazione da CO_2 sulla temperatura interna nel coniglio. —— Rivista di medicina aeronautica e spaziale (Roma), 25 (1): 78-86. Jan.-March 1962. In Italian, with English summary (p. 85).

Rabbits breathing humid air containing 7% carbon dioxide for two hours showed a decrease in rectal temperature similar to that observed in animals breathing environmental air. The rectal temperature of the same rabbits breathing a dry mixture of 7% carbon dioxide also decreased, but at a slightly higher rate. The behavior of the pulmonary ventilation clearly demonstrated that the presence of 7% carbon dioxide produces an increase in volume/minute under the conditions studied; however, the increase is greater during inhalation of the mixture previously humidified. Consideration is given to the importance of these findings to persons working in confined quarters or working for short periods in areas with high carbon dioxide levels.

2044
Long, D. M.,
R. L. Clancy, and E. B. Brown
ROLE OF ABDOMINAL VISCERA IN THE HYPERKALEMIA PRODUCED BY HYPERCAPNIA. —— Amer. Jour. Physiol., 204 (5): 753-756. May 1963.

The changes in plasma potassium concentration during and following breathing of high carbon dioxide mixtures were determined in dogs subjected to (1) enterectomy, (2) pancreatectomy, (3) hepatectomy, and (4) abdominal evisceration. Plasma potassium increased during the hypercapnia and increased still further in the immediate posthypercapnic period. The direction of these changes was the same as those in the control animals although some quantitative differences were observed. It was concluded that the hyperkalemia was not supplied by the liver, pancreas, or stomach and intestines since it appears in the absence of any or all of these organs. (Authors' abstract)

2045
Milic-Emili, J.,
and J. M. Tyler
RELATION BETWEEN WORK OUTPUT OF RESPIRATORY MUSCLES AND END-TIDAL CO_2 TENSION. —Jour. Applied Physiol., 18 (3): 497-504. May 1963.

End-tidal CO_2 tension, pulmonary ventilation, and work output of respiratory muscles were determined in six normal subjects breathing various mixtures of carbon dioxide in air, with three graded resistances added to both inspiration and expiration. In two individuals, the resistances were also added separately to inspiration or expiration. A linear relationship was found between work output of inspiratory muscles and end-tidal CO_2 tension; this relationship was uninfluenced by added resistance. No consistent relationship was observed between either ventilation or work output of expiratory muscles and end-tidal CO_2 tension. These results suggest that carbon dioxide controls directly the activity of inspiratory muscles alone and that the activity of expiratory muscles is only coincidentally involved. The possible role of intrinsic properties of respiratory muscles and of nervous mediation in the control of breathing is discussed. (Authors' abstract)

2046
Molè, R.,
and M. Ferrari
[OXYGEN CONSUMPTION OF THE GUINEA PIG HEART DURING ACUTE CARBON MONOXIDE POISONING] Il consumo d'ossigeno del cuore di cavie nell'intossicazione acuta da ossido di carbonio.—Biochimica applicata (Parma), 10 (1): 51-57. Jan.-Feb. 1963. In Italian.

Acute carbon monoxide poisoning in guinea pigs produced a decrease in cardiac oxygen consumption as demonstrated by the histopathological examination of cardiac sections (right and left ventricles, right and left auricles, atrial and ventricular septa), thereby indicating a significant change in tissue function. This decrease was not related to anoxemia, but to the direct toxic effect of carbon monoxide on the respiratory enzymes of the myocardial cells. Included are tables of the cardiac oxygen consumption in normal guinea pigs, after acute carbon monoxide poisoning, and in a nitrogenous atmosphere.

2047
Murphy, S. D.,
C. E. Ulrich, and J. K. Leng
ALTERED FUNCTION IN ANIMALS INHALING CONJUGATED NITRO-OLEFINS.—Toxicol. and Applied Pharmacol., 5 (3): 319-330. May 1963.

Increased total pulmonary flow resistance and tidal volumes and decreased respiratory rates of guinea pigs, and decreased voluntary activity of mice occurred during inhalation of vapors of conjugated nitro-olefins (2-nitro-2-butene, 3-nitro-3-hexene, and 4-nitro-4-nonene) at concentrations near or below the threshold for human sensory detection. The response of animals to inhaled nitro-olefins qualitatively resembles effects which were observed when animals inhaled high concentrations of irradiated automobile exhaust. Conjugated nitro-olefins might be formed as reaction products between nitrogen oxides and olefinic hydrocarbons in exhaust gases of automobiles and from other sources. (Authors' summary, modified)

2048
Naeraa, N.,
E. S. Petersen, and E. Boye
THE INFLUENCE OF SIMULTANEOUS, INDEPENDENT CHANGES IN pH AND CARBON DIOXIDE TENSION ON THE IN VITRO OXYGEN TENSION-SATURATION RELATIONSHIP OF HUMAN BLOOD.—Scandinavian Jour. Clinical and Lab. Investigation (Oslo), 15 (2): 141-151. 1963.

The present investigation was undertaken to find out whether a specific, i.e. pH-independent, effect of carbon dioxide on the oxygen affinity of hemoglobin could be demonstrated in human whole blood subject to variations within physiological limits. The experimental procedure comprised the equilibration of blood samples with various, artificially induced, metabolic acid-base abnormalities at four different carbon dioxide tensions and at oxygen tensions of 50 and 90 mm Hg, respectively. Oxygen saturation and pH were then determined. The results demonstrate that carbon dioxide increments—apart from the change in pH—especially decrease the oxygen affinity of whole blood. This effect is most pronounced at a pH below 7.3 and low oxygen tension. At P_{O2} about 90 mm. Hg it is hardly significant. (Authors' summary, modified). (26 references)

2049
Okajima, M.,
and E. Simonson
EFFECT OF BREATHING SIX PER CENT CARBON DIOXIDE ON ECG CHANGES IN YOUNG AND OLDER HEALTHY MEN. —— Jour. Gerontol., 17 (3): 286-288. July 1962.

Electrocardiographic changes produced by breathing a mixture of 6% CO_2 with air for 6 to 8 minutes were studied in 148 healthy men (88 older men and 60 younger men). The most prominent change in the electrocardiogram was a statistically significant decrease in the amplitudes of QRS and T frontal plane mean vectors which was more pronounced in the older men and may imply a decreased tolerance of older people to CO_2 excess. (Authors' summary)

2050
Ringold, A.,
J. R. Goldsmith, H. L. Helwig, R. Finn, and F. Schuette
ESTIMATING RECENT CARBON MONOXIDE EXPOSURES. —— Arch. Environmental Health, 5 (4): 308-318. Oct. 1962.

A valid method for determining the carboxyhemoglobin level in the body is described. It is based on the 20-second breath-holding method using an infrared analyzer. A polyvinyl bag can be used for collection of samples in the field. This method appears to be suitable for studying the relationship of carboxyhemoglobin to occupational and to ambient air pollution exposures. Representative tables and graphs are included.

2051
Rosenholtz, M. J.,
T. R. Carson, M. H. Weeks, F. Wilinski, D. F. Ford, and F. W. Oberst
A TOXICOPATHOLOGIC STUDY IN ANIMALS AFTER BRIEF SINGLE EXPOSURES TO HYDROGEN FLUORIDE.—Amer. Indus. Hyg. Assoc. Jour., 24 (3): 253-261. May-June 1963.

The LC_{50} values for single exposures to hydrogen fluoride were found to be 4970, 2690, 2040, and 1310 parts per million for rats exposed respectively for periods of 5, 15, 30, and 60 minutes. Rats, dogs, and rabbits were exposed also to concentrations of 6% to 50% of the LC_{50} values for rats. Signs of intoxication and pathology are described. Renal and hepatic lesions were noted. Human sensory levels may be more sensitive than animal studies in establishing tolerable levels for brief human exposures. (Authors' abstract)

2052
Rossen, R.,
E. Simonson, and J. Baker
ELECTROENCEPHALOGRAMS DURING HYPERCAPNIA. —— Arch. Neurol., 8 (4): 373-381. April 1963.

In 45 young and 64 older, normal men, 12 of the young men (mean age 24.4 years) and 15 of the older men (mean age 60.7 years) showed slight changes on the EEG during breathing of a 6% CO_2 gas mixture. Older age seemed to correlate with a statistically highly significant greater increase in hyperventilation (with a slightly greater increase in alveolar CO_2 than in young men) in subjects with slight changes in EEG. Older age seemed to correlate also with a statistically significant greater increase in alveolar CO_2 in subjects with no essential changes in EEG. (Authors' summary, modified)

2053
Schaefer, K. E.
ACCLIMATIZATION TO LOW CONCENTRATION OF CARBON DIOXIDE.—Revue de médecine aéronautique (Paris), 1 (2): 129-131. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (1): 11-13. Jan. 1963.

Twenty-one subjects were confined in a submarine and exposed to 1.5% carbon dioxide over a period of 42 days, with a nine-day control period prior to and following exposure. The results showed no significant changes in performance or in basic physiological parameters such as blood pressure, pulse rate, weight, and body temperature. However, respiration, acid-base balance, and calcium-phosphorus metabolism showed remarkable adaptive changes. The long time periods required for acclimatization to 1.5% carbon dioxide (23 days) and deacclimatization (the latter not being completed after four weeks of recovery on air) suggest that some kind of pathophysiological state might develop under these conditions. In view of the persisting increase in red cell calcium and decrease in red cell phosphorus as well as the maintained reduction in cardiovascular capacity after an extended period of four weeks following exposure, it is doubtful whether long continued adaptation to slightly increased carbon dioxide tension levels can be accomplished without altering normal physiological processes.

2054
Shabalin, V. A.
[ON THE CHARACTERISTICS OF CHANGES IN THE CONDITIONED REFLEX REACTIONS IN PEOPLE DURING THE ACTION OF CARBON MONOXIDE AND VIBRATION] O kharaktere izmeneniia uslovnoreflektornykh reaktsii liudei pri vozdeistvii okisi ugleroda i vibratsii. —Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 53 (1): 45-47. Jan. 1962. In Russian, with English summary (p. 47).

Conditioned reflexes (CR) were elaborated in four groups of 9 subjects each, as follows: (a) Group I – blinking to sound as the conditioned stimulus (CS) and air blast as the unconditioned stimulus (UCS): (b) Group II – motor CR's (according to A. G. Ivanov-Smolenskii) with speech reinforcement to yellow and green lights as the positive stimulus and red light as the negative stimulus; (c) Group III – latencies of reactions to sound and color signals during electrical stimulation of the skin on the forearm; and (d) Group IV – simple reaction times registered to the appearance of colored stimuli without UCS reinforcement. Experimental conditions involved a 15-20 min. exposure to carbon monoxide in concentrations up to 2.5 mg./liter, and vibrations of 15-18 jolts per minute at an impact level of 1.5-2 g. Under both conditions variability of CR latencies was considerably reduced, suggesting lowered functional mobility of the cortical processes.

2055
Takács, L.,
and K. Kállay
EFFECT OF CARBON DIOXIDE INHALATION ON THE CIRCULATION OF THE ANESTHETIZED RAT. —Acta physiologica Academiae scientiarum hungaricae (Budapest), 23 (1): 13-19. 1963. In English.

No effects were observed in the circulation of anesthetized rats breathing a 3% carbon dioxide mixture for 4-10 minutes. In response to 20% carbon dioxide for 4-6 minutes a severe peripheral vasodilation developed, and in spite of increased cardiac output, blood pressure decreased. This vasodilation was most marked in the liver and intestines, and least marked in the kidney and musculo-skeletal system. As a result, circulation through the organs increased unevenly. Hepatic and intestinal circulation increased considerably, but much less in the coronaries, bronchial arteries, and skin. Circulation through the kidneys and musculo-skeletal system was unchanged. (Authors' summary, modified) (63 references)

2056
Ulvedal, F.,
R. G. Cutler, and B. E. Welch
EFFECTS OF HIGH CONCENTRATIONS OF CARBON DIOXIDE AND DIET ON URINARY EXCRETION OF STEROIDS AND CATECHOLAMINES.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 793002). Technical Documentary Report no. SAM-TDR-63-63, Aug. 1963. iii + 12 p.

Air Force pilots were exposed to inspired tracheal P_{CO_2} of 21 mm. Hg at 700 mm. and 200 mm. Hg cabin pressure. Each exposure was of 4 days' duration and was preceded in each case by a control period of low CO_2 also of 4 days' duration at the equivalent cabin pressures. During the entire experiment, including pre- and postexperiment control periods, the subjects were given a special liquid diet. The effects of CO_2 and diet on the endocrine functions were studied by determining the urinary excretion of epinephrine, norepinephrine, 17-hydroxycorticoids, and corticosterone-like hormones. It was found that the CO_2, both at ground and at simulated altitude, increased the excretion of epinephrine, norepinephrine, and corticosterone-like hormones. CO_2 at simulated altitude had a stronger effect than at ground level. The special liquid diet caused increased excretion of epinephrine, while the excretion of the other three hormone groups decreased. (Authors' abstract)

2057
West, J. B.
DIFFUSING CAPACITY OF THE LUNG FOR CARBON MONOXIDE AT HIGH ALTITUDE. —Jour. Applied Physiol., 17 (3): 421-426. May 1962.

Diffusing capacity of the lung for carbon monoxide (DL) was measured in London, at 15,300 ft., and at 19,000 ft. on seven members of the Himalayan Scientific and Mountaineering Expedition, 1960-61. At each altitude DL was measured at two work levels (300 and 900 kg.-m./min.) and at three different inspired oxygen tensions in order to separate membrane and blood components of the diffusing barrier. There was no consistent change in DL at 15,300 ft. (subjects breathing ambient air) compared with sea level, but DL was significantly increased after 7-10 weeks at 19,000 ft. (mean changes of 15 and 19% for work levels of 300 and 900 kg.-m./min., respectively). However, this small change in DL can be wholly accounted for by the increased rate of reaction of carbon monoxide with hemoglobin due to hypoxia and by the increased blood hemoglobin concentration. (From the author's abstract)

e. Other Substances

2058
Bellet, S.,
J. W. West, O. F. Müller, and U. C. Manzoli
EFFECT OF NICOTINE ON THE CORONARY BLOOD FLOW AND RELATED CIRCULATORY PARAMETERS: CORRELATIVE STUDY IN NORMAL DOGS AND DOGS WITH CORONARY INSUFFICIENCY. — Circulation Research, 10 (1): 27-34. Jan. 1962.

Nicotine (20 μg./kg./minute) administered intravenously to the normal intact dog increased cardiac work markedly by increasing the mean arterial blood pressure and cardiac output. An increase was also produced in coronary blood flow which rose as much as 125% over the control value.

2059
Hathaway, J. A.,
and R. E. Terrill
METABOLIC EFFECTS OF CHRONIC OZONE EXPOSURE ON RATS. — Indus. Hygiene Jour., 23 (5): 392-395. Sept.-Oct. 1962.

Young male rats were exposed to 0.8-1.5 parts per million of ozone for 6 hours a day, 4 days a week for approximately 19 weeks, and various quantitative analyses of urinary constituents were made. A significantly lower titratable acidity and a higher pH were found in urine from test animals than from controls. No significant difference was observed in the standard deviations for 16-hour creatinine, creatine, uric acid/creatinine, and amino acid nitrogen/creatinine excretion. Handicapped by narrow openings through which to obtain food, mean food intake and weight gain were consistently less in exposed than in control rats. When this condition was remedied food consumption and weight gain were comparable in both groups.

2060
Irving, D. W.,
and T. Yamamoto
CIGARETTE SMOKING AND CARDIAC OUTPUT. — Brit. Heart Jour., 25 (1): 126-132. Jan. 1963.

The cardiac output during smoking was measured with the dye-dilution technique. "Sham" smoking an unlit cigarette or smoking without inhaling caused only slight changes in the cardiac output, while smoking with inhaling caused a large increase in the cardiac output and stroke volume. Intravenous nicotine caused changes in the cardiac output similar to those seen when inhaling smoke. Associated with the increased cardiac output were sinus tachycardia, widening of the pulse pressure due to an increased systolic blood pressure, and an increase in the stroke volume. (Authors' summary)

2061
Klebelsberg, D.
[DIFFERENTIAL EFFECTS OF A BLOOD ALCOHOL CONCENTRATION IN THE AMOUNT OF 1.0 PER MILL ON VARIOUS PSYCHIC COMPONENTS OF DRIVING ABILITY] Unterschiedliche Auswirkungen einer Blutalkoholkonzentration von 1,0 promille bei einzelnen psychischen Komponenten der Fahrtüchtigkeit.—Zeitschrift für experimentelle und angewandte Psychologie (Göttingen), 9 (1): 1-11. 1962. In German, with English summary (p. 10).

Experiments showed that a blood alcohol concentration of 1.0 per mill has its strongest effect on (a) the reactive capacity of the psychomotor system as determined with the Kiel psychomotor test apparatus—a significant negative influence, and (b) on subjective evaluation of performance as determined by the Graphic Rating Scales: at first there is a temporary marked deterioration, then a pronounced improvement in spite of the generally negative objective measurements of performance. A lesser negative effect was observed also on visual performance with respect to concentration and fixation, ability to concentrate, and on ability for adaptive reactions. Simple reaction time, choice reaction time, and sensorimotor coordination on a simulated driver's seat were not affected. These findings suggest a necessity for differentiation between a decrease in performance due to alcohol and unfitness to drive due to alcohol.

2062
Laurell, L.
[ALCOHOL ANALYSES MADE FOLLOWING AIRCRAFT ACCIDENTS IN THE SWEDISH AIR FORCE] Des analyses d'alcool faites à la suite d'accidents aériens dans l'Armée de l'Air Suédoise. — Revue de médecine aéronautique (Paris), 1 (4): 13-15. July-Aug. 1962. In French.

Tabulations are presented of 86 cases of postmortem analyses of alcoholemia in pilots involved in aircraft accidents. Two methods were used: the chemical micro-method of Widmark, and the ADH enzyme method utilizing alcohol dehydrogenase as a reagent. Forty-seven of the 92 cases investigated showed no evidence of alcohol, 18 were doubtful, 14 revealed small traces of alcohol, and in 13 the evidence was irrefutable. Specimens from cadavers in various stages of decomposition were analyzed by both the Widmark and ADH methods. Two sources of error were found: (1) false positive results due to the formation of reductive and volatile substances accompanying the decomposition process, and (2) post-mortem formation of alcohol occurring within one or two days. Since the body of a pilot is frequently recovered in a humid terrain or near the burning aircraft, the postmortem formation of alcohol is accelerated.

2063
Leeuwe, H.
[ON THE POSSIBLE DANGERS ASSOCIATED WITH THE USE OF FREON 12 (DICHLORO-DIFLUORO-METHANE)] Over de mogelijke gevaren bij het gebruik van freon 12 (dichloro-difluoromethaan).—Aeromedica acta (Soesterberg, The Netherlands), 8: 103-125. 1961-1962. In Dutch, with English summary (p. 124-5).

Toxicity of Freon 12 used in the aircraft cooling system was investigated as a possible cause of aircraft accidents. The experiments were carried out on mice. With respect to direct toxicity, Freon 12 was found to be harmless in concentrations ranging up to 16 vol. % for at least a 5-hour exposure. In higher concentrations it acts as an asphyxiant. Freon 12 with an admixture of oxygen becomes narcotic at 60 vol. %. Chronic exposure does not result in its accumulation within the organism. No chronic toxic symptoms could be observed. Pyrolytic decomposition products of Freon 12 are highly toxic with a fatal outcome. There is however, adequate warning since they are also extremely irritating to the eyes and mucous membranes. On the basis of the concentrations available in the cockpit under the most unfavorable circumstances and the absence of any open flame, the author is of the opinion that Freon 12 would not be a likely cause of aircraft accidents.

2064
Lodeesen, M.,
and J. E. Crane
FASTEN SEATBELTS: NO SMOKING.—Airline Pilot, 32 (6): 12-13, 14. Aug. 1963.

The effects of smoking on man generally and on the pilot in particular are discussed. A survey of smoking habits on 100 pilots and the effects of smoking on night vision are included. The results obtained in over 6000 patients in six tobacco-withdrawal clinics in Stockholm, Sweden, are also discussed.

2065
Rao, V. R.,
and T. H. Rindani
THE INFLUENCE OF SMOKING ON ELECTROMYOGRAMS. —— Jour. Postgraduate Med. (Bombay), 8 (4): 170-172. Oct. 1962.

Electromyographic changes induced by smoking were studied in the small muscles of the hand. The findings of a decrease in the impulse frequency on maximal effort, the appearance of large-size polyphasic elements, and even the appearance of spontaneous activity at rest were seen after smoking in individuals below 35 years of age. They were not marked in older individuals who were habitual smokers. It is suggested that carbon monoxide and nicotine absorbed are responsible for the changes seen. Carbon monoxide contributes to the changes only to a small extent, the major effect being caused by nicotine on the myoneural junction and ganglia.

2066
**Shapiro, W.,
and J. L. Patterson
EFFECTS OF SMOKING AND ATHLETIC CONDITIONING ON VENTILATORY MECHANICS, INCLUDING OBSERVATIONS ON THE RELIABILITY OF THE FORCED EXPIROGRAM. —— Amer. Rev. Respir. Diseases, 85 (2): 191-199. Feb. 1962.**

Ventilatory functions before and after smoking were studied in 25 superbly trained athletes, 11 nonsmokers, and in 31 smokers who were not athletes. Repetition of the forced expirogram at brief intervals yielded nearly constant values, unaffected by acute smoking. Athletic conditioning was associated with an increased expired vital capacity (EVC) without the same relative increase in the first-second forced expiratory volume (FEV$_1$). Chronic smoking was associated with a decreased mean maximal breathing capacity (MBC). The presence of both factors resulted in large differences in the EVC, MBC, and the entire forced expirogram in comparable men, the higher values being in nonsmoking athletes. Judgments of ventilatory performance based on the FEV$_1$ may be misleading in persons with large vital capacities unless expressed as per cent of predicted rather than as per cent of observed EVC. No alterations in function were observed immediately after smoking, aside from slight variations in MBC. (From the authors' summary)

10. SAFETY, SURVIVAL, AND RESCUE

[*Evacuation of patients under 8-e*]

a. General

2067
Burdick, R. L.
DETERMINATION OF TEST INSTRUMENTATION REQUIREMENTS FOR BIOLOGICAL AIRBORNE AND ASTRONAUTICAL TESTS: THE PSYCHOMOTOR TASK AS A MONITOR OF SUBJECT SAFETY.—Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Problem Assignment no. CO4AE13-2). Report no. NAMC-ACEL-486, July 30, 1962. iv+12 p.+3 plates.

When a human subject is exposed to hazardous experimental conditions, it is frequently advisable to provide automatic warning of the approach of danger to the subject. Under certain circumstances, it may be possible to use a psychomotor task for this purpose. This report discusses the factors which determine the suitability of such a task for this purpose in any given experiment and the methods by which specific selection of the task may be accomplished. The principles and methods discussed are illustrated by a concrete example. (Author's abstract)

2068
Hoekstra, H. D.,
and I. H. Hoover
THE FAA AIRCRAFT SAFETY DEVELOPMENT PROGRAM. — Institute of the Aerospace Sciences, New York, N. Y. IAS Paper no. 63-44, 1963.

The Federal Aviation Agency (FAA) has provided substantial improvements in safety and safety standards resulting from many years of aeronautical safety development work. The present FAA program will yield additional safety gains through better protection against crash fires, crash injury, engine change, and sabotage. This will be achieved with improved recorders and other equipment. The program provides a better understanding of aircraft performance on take-off and landing under adverse conditions and of the flight performance and characteristics of rotocraft. Future FAA aircraft safety research and development work will bring additional gains in safety. (Authors' conclusions, modified)

2069
Roadman, C. H.,
and F. B. Voris
LIFE SUPPORT FOR MANNED SPACE FLIGHT. — AIBS Bulletin, 12 (5): 53-55. Oct. 1962.

Personal, life support, and environmental systems are discussed as needed for present and future spacecraft. In addition to support systems within the spacecraft, systems needed to support man free in space away from his vehicle are also considered. Man's physiological requirements differ little in either situation. However, engineering problems are involved in supporting an isolated individual that do not occur in providing for him within the vehicle. If man is to extend his exploration range to any distance from the vehicle, he must carry his support system with him. Support of man in space for prolonged periods is the largest problem to be solved in manned space flight. Survival equipment must be effective for both water and land impacts, in the Arctic as well as in the Tropics.

b. Protective Equipment and Clothing

[*Warning devices under 11-c*]

2070
Barnes, T. G.,
E. M. Finkelman, and A. L. Barazotti
RADIATION SHIELDING OF LUNAR SPACECRAFT. — In: Lunar exploration and spacecraft systems, p. 52-71. Ed. by R. Fleisig and others. New York: Plenum Press, 1962.

A description of the radiation environment to be encountered in space is presented. A model of the spatial, spectral, and temporal variation of charged particles from the Van Allen belts and cosmic radiation is established. Calculations have been performed to determine the relative effectiveness of varying thicknesses of different shielding materials as a function of geometry of the shield. Tissue dose rate variation with time for a typical three-dimensional lunar trajectory is presented and compared to flight radially in the plane of the magnetic equator. The total integrated biological dose as a function of carbon shield thickness was calculated for four solar flare events, and for flight radially out through the inner belt. It is shown that approximately 10 g./cm.^{2} of carbon shielding is sufficient to shield not only the inner-belt protons, but would also provide adequate protection against solar flares of the magnitude that occurred in March and August of 1958. It was found to be impossible to shield against solar flares of the highest known energy within the reasonable weight limits of a typical lunar mission. (Authors' abstract, modified)

2071
Barnett, P. W.,
and K. R. Skrettingland
AN EXPERIMENTAL WINTER FLYING GLOVE.— Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-1). Technical Note no. AAL TN-63-1, Jan. 1963. 7 p.

Loss of tactile discrimination and dexterity during critical phases of flight are common to Arctic operations. The development of more efficient handwear would greatly enhance flying safety. A mouton glove was designed which maximized insulation and minimized impairment. Following field trials, this glove was compared with the MA-1 glove and the N-4B arctic mitten. Although the experimental glove compared favorably, it possessed no advantages worthy of additional consideration. While significant differences in temperature maintenance of the hand can be attributed to variations in the configuration of equivalent amounts of insulation, these differences (two degrees) are only of academic importance, and diminish with decreasing ambient temperatures. (Authors' abstract)

2072
Bartlett, R. G.
DESIGN CONCEPTS FOR DOME TYPE HELMET IMPROVEMENTS. —— Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3100, Subtask 6). Report no. 4, June 13, 1962. ii+11 p.

The design concepts for a modification of the dome-type (neck-seal) helmet are presented. The modified helmet is designed to: (1) prevent fogging, (2) conserve breathing oxygen stores, (3) provide crash protection, (4) control the added anatomical dead space for CO_2 accumulation, (5) ameliorate or prevent hyperventilation, and (6) humidify the dry inspired oxygen. The use of the device is optional and it may or may not be used on any time schedule during the flight. (From the author's summary)

2073
Bartlett, R. G.
A STUDY OF CO_2 BUILD-UP WITH A NECK SEAL SUBSTITUTED FOR THE FACE SEAL IN THE FULL PRESSURE SUIT HELMET. —— Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-3100, Subtask 8). Report no. 11, June 8, 1962. ii+11 p.

Breath-by-breath CO_2 levels were compared for two seal configurations: the face seal now used in both the Air Force and Navy pressure suits (advantages, smallness of dead space and of rebreathing, facilitating delivery of dry oxygen in a number of fine streams over the face plate eliminating fogging of the aviator's vision, but requiring personal fitting for reasonable comfort and restriction of head movement) and the neck seal (which would eliminate the undesirable aspects of the face seal provided no dead space or CO_2 problem is created). The pCO_2 measurements revealed zero to 1.5% difference in CO_2 levels with the face seal and the neck seal. Such differences should not disqualify the neck seal for further consideration.

2074
Baum, J. V.,
B. Goobich, and T. M. Trainer
AN EVALUATION OF HIGH-PRESSURE OXYGEN SYSTEMS.—Battelle Memorial Inst., Columbus, Ohio (Contract AF 33(616)-8267); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637302). Technical Documentary Report no. AMRL-TDR-62-102, Sept. 1962. viii+85 p.

The relative safety of 7500 p.s.i. gaseous oxygen systems when used as a source of breathing oxygen in aerospace vehicles was investigated. The program of study included determining the effects on the system of temperature, vibration, shock, extended storage, contamination, high pressure, high-velocity flow, and heating due to rapid compression. Evaluation of the results of this program indicates that 7500 p.s.i. gaseous oxygen systems can be comparatively safe if proper safety precautions are taken. The precautionary measures to be used are given. Areas needing further detailed investigation before high-pressure gaseous oxygen systems are used extensively are described. (Authors' abstract, modified)

2075
Beck, E. P.,
J. Ernsting, and C. Lythgoe
PHYSIOLOGICAL ASSESSMENT OF THE ROBERTSHAW-FULTON REGULATOR TYPE 20004. —— RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC Memo no. 175, Sept. 1962. i+19 p.

Although it was not designed for use with pressure clothing, the capability of the Robertshaw-Fulton Regulator Type 20004 to inflate current R.A.F. partial clothing following rapid decompression was assessed. In the two rapid decompressions which were performed with the regulator, the jerkin and mask were pressurized rapidly, and the absolute pressure in the mask did not fall below the final absolute pressure delivered by the regulator for longer than one second. These preliminary experiments suggest that this device will produce the flow of gas necessary to inflate present R.A.F. pressure jerkin assemblies within the time required by physiological considerations. By suitable modification of the pressure breathing aneroid and the associated orifice, this regulator can be made to deliver the pressure breathing characteristics used in the pressure jerkin assemblies.

2076
Beck, E. P.,
J. Ernsting, and C. Lythgoc
PHYSIOLOGICAL ASSESSMENT OF A MODIFIED FIREWEL REGULATOR TYPE 1732.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC/Memo. 189, Nov. 1962. ii+17 p.

The behavior of a single sample of a modified Firewel miniature oxygen regulator Type 1732 was determined. The resistance to breathing imposed by this regulator when mounted on the chest is slightly less than that imposed by current R.A.F. pressure-demand equipment. The regulator fulfills the inflation requirements for R.A.F. partial-pressure equipment. The manner in which the regulator fails to meet current R.A.F. requirements for oxygen equipment is discussed. It is considered that these deficiencies, apart from the provision of airmix, can be overcome by relatively simple changes. It is recommended that further samples of the Firewel miniature regulator should be studied in order that a more comprehensive picture of the behavior of this type of regulator may be obtained. The results of this study are sufficiently encouraging to suggest that a prototype aircrew equipment assembly incorporating this regulator as an emergency regulator should be developed. (Authors' summary)

2077
Bosee, R. A.,
and J. F. Kiefer
A HISTORY OF THE U. S. NAVY FULL PRESSURE HIGH ALTITUDE SUIT.—Naval Air Material Center, Air Crew Equipment Lab., Philadelphia, Pa. (Problem Assignment no. C44AE22-1). Report no. NAEC-ACEL-499, May 10, 1963. iii+10 p., 7 figures.

(Paper presented at the 19th Meeting of the Aerospace Medical Panel of the Advisory Group for Aeronautical Research and Development, North Atlantic Treaty Organization, Paris, France, 6 to 10 July 1962). The evolution of the Navy Full-Pressure Suit from 1955 to 1962 is described.

2078
Colin, J.,
Ch. Jacquemin, P. Varene, and H. Ducros
[CONTRIBUTION TO THE STUDY OF CLIMATIC CLOTHING] Contribution à l'étude des vêtements climatisés.—Revue de médecine aéronautique (Paris), 1 (3): 73-75. March-April 1962. In French.

Experiments testing the efficiency of the French flying suit DTI, Type 1, No. 2, in hot environments are described. Continuous registrations were made of rectal, skin, esophageal, and central temperatures, while the subject was at rest prior to the experiment, and metabolic evaluations, in order to determine the flow of heat penetrating the suit as compared with other types of clothing. When thermal comfort was subjectively attained, the central temperature dropped in a constant and significant manner, even when skin temperature was stable or increased. Results with experiments with climatic cloths, and the subject at rest with protective clothes revealed that the clothing was suitable if the caloric level was null and the subject previously was able to rest for at least two hours. Inability of the subject to rest for this length of time necessitated a negative caloric level in order to make the clothing suitable. Included are representative tables.

2079
Cresswell, A. W.,
and J. Ernsting
AN ASSESSMENT OF THE BEAGLE COMBINED COMPENSATED OUTLET AND RATE SENSITIVE DUMP VALVE.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC/Memo. 183, May 1962. ii+24 p.

The performance of a prototype combined compensated outlet and rate-sensitive dump valve developed by the Beagle Aircraft Company was evaluated against the physiological requirements. The valve, which can be fitted into a standard P or Q pressure demand mask, acts as a compensated outlet valve under normal cabin conditions. In the event of a sudden decompression, however, the valve becomes decompensated and thus allows the free egress of the gases expanding in the respiratory tract. The use of this valve greatly reduces the potentially lethal situation which can arise during the rapid decompression of a high differential pressure cabin when standard pressure demand oxygen equipment is worn. It is recommended that the prototype valve described in this report should be developed into a production item. It should, as a matter of urgency, replace the standard compensated valve fitted to current R.A.F. and R.N. pressure demand oxygen masks. (Authors' summary)

2080
Culver, J. F.,
and A. V. Adler
PROTECTIVE GLASSES AGAINST ATOMIC FLASH. — In: Visual problems in aviation medicine, p. 34-38. Ed. by A. Mercier. Oxford: Pergamon Press, 1962.

Various devices are discussed, designed to provide adequate protection of aircrew members against atomic flash. Among them are electromechanical goggles, fixed-density filters, and electro-optic and magneto-optic devices. A promising protective method is based on phototropy, a phenomenon whereby absorption of a particular band of the spectrum causes a change of absorption of photoreactive materials. However, the energy dependence of photoreactive materials is an inherent limitation as far as eye-protective devices are concerned. An actuator system to sense incident illumination and trigger ultraviolet producing gas discharge tubes was developed (flashblindness interim device). With continued improvement of this system protection from permanent retinal damage is assured, since more energy is required to burn than flashblind, and may be used in future space vehicles.

2081
David, H. M.
BASIC AF SPACESUIT DESCRIBED. — Missiles and Rockets, 10 (10): 18. March 5, 1962.

A brief description is presented of a spacesuit which can be worn outside a space vehicle in flight at altitudes of from 300 to 500 nautical miles during a mission lasting 2-5 months. The suit is to be worn for no longer than 4 hours outside the vehicle and 8 hours inside. The major design problems to be overcome include extreme variation in environmental temperatures; solar flares requiring warning devices, emergency procedures, and equipment; helmet and ear cups for the noise of launch and re-entry; regulation of oxygen supply; and development of an easy donning method.

2082
Ernsting, J.
THE PERFORMANCE OF THE ROBERTSHAW-FULTON MINIATURE REGULATOR, TYPE 20004, WHICH PROVIDES AUTOMATIC SAFETY PRESSURE, IN A PRESSURE ECONOMISER SYSTEM.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.), Report no. FPRC/Memo. 185, Aug. 1962. iii+26 p.

The behavior of three samples of the Type 20004 Robertshaw-Fulton regulator which provides automatic safety pressure was studied with respect to their suitability for use in various pressure economizer systems. The delivery pressure characteristics of two of the sample regulators were adequate to ensure that safety pressure was maintained in the mask cavity during inspiration. The other regulator did not fulfill this requirement. The behavior of a pressure economizer system incorporating this type of Robertshaw-Fulton regulator and using a standard R. A. F. pressure demand mask was examined in detail at simulated altitudes up to 25,000 feet. The performance of the system was in all respects either comparable with, or better than, that of present aircraft installations based upon the Mark 17, 20, and 21 series regulators. It is recommended that a practical working aircrew assembly based upon the principle of the pressure economizer and using the Type 20004 Robertshaw-Fulton regulator should be constructed for assessment. (From the author's summary)

2083
Ernsting, J.
THE BEHAVIOR OF CERTAIN FIREWEL MINIATURE OXYGEN REGULATORS IN THE PRESSURE ECONOMISER SYSTEM.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC/Memo. 190, Nov. 1962. ii+17 p.

The suitability of the Firewel mask-mounted oxygen regulator and of the Firewel helmet-mounted regulator (for the Goodrich Mark 4 full pressure suit) for use in a pressure economizer was examined. The delivery pressure at a given flow of each of these regulators increases as the inlet pressure to the regulator is reduced. When used in a pressure economizer system the delivery pressure of each of these regulators rises excessively at the beginning of expiration. When the outlet valve is compensated, this characteristic leads to an excessive resistance to expiration; when a spring-loaded outlet valve is used as in the Goodrich helmet, there is a loss of oxygen from the system. Neither of these Firewel tilt-valve regulators which provide safety pressure is suitable for use in a pressure economizer system. (Author's summary)

2084
Fletcher, J. L.,
and M. Loeb
FREE FIELD THRESHOLD SHIFT AND TEMPORARY THRESHOLD SHIFT REDUCTION AS MEASURES OF EFFICIENCY OF EAR PROTECTIVE DEVICES. —Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X96-25-001). Report no. 539, May 28, 1962. ii+12 p.
Also published in: Jour. Acoust. Soc. America, 34 (10): 1629-1633. Oct. 1962.

Protection (noise attenuation) is evaluated of two insert and one helmet-type protector by means of the free-field threshold shift (FFTS) and temporary threshold shift reduction (TTSR) techniques using both continuous and impulse noise exposure. All devices tested were shown to significantly reduce TTS under both conditions. The insert devices were more effective than the helmet at low frequencies, but both were approximately equal in effectiveness at high frequencies. It is believed that the TTSR technique adds important information regarding the operational efficiency of the ear protectors tested. Because of the special problems associated with helmets, it seems particularly desirable to include the TTSR technique in their evaluation. The data suggest that susceptibility to TTS from continuous exposure is not significantly correlated with that from impulse exposure. (Authors' abstract, in part)

2085
Flexman, R. E.,
L. M. Seale, and C. Henderson
DEVELOPMENT AND TEST OF THE BELL ZERO-G BELT.—Bell Aerosystems Co., Buffalo, N.Y. (Contract AF 33(657)-9224); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-63-23, March 1963. vi+103 p.

The assumption is made that a requirement exists for the development of a self-maneuvering system for orbital workers. Such a system will consist of a life support subsystem, maintenance equipment (tools), and a propulsion and control subsystem. This report discusses the general problem areas and specifically reports on the research, development, and testing of the Bell Zero-G Belt, a research propulsion and control system for maneuvering a man in a weightless environment. The flight tests of the belt took place on a large airbearing platform and in a C-131 cargo-type aircraft during zero-g trajectories. The equations of motion derived during the Bell Aerosystems Company sponsored development of the Small Rocket Lift Device (Rocket Belt) are also presented and discussed with respect to the Zero-G Belt. Specific conclusions are presented on the adequacy of the research model of a propulsion system and recommendations are made for additional research and development. (Authors' abstract)

2086
Fonash, R. L.
PROTECTIVE GARMENT FOR ASTRONAUTS EMPLOYING SUBLIMATING SALTS. —U. S. Patent 3,032,772, May 8, 1962.

A garment is described having heat-protecting properties. The suit is made of layers of cloth, and between the layers are various types of anthraquinones.

2087
Gabb, J. E.
PROTECTION OF THE HEAD.—Revue de médecine aéronautique (Paris), 1 (2): 210-212. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (2): 76-78. Feb. 1963.

A description is presented of a test used to evaluate the British standard protective helmet (Mk. 1A), which incorporates high-speed photography and impact from a block falling on the helmet. The test resulted in the development of a better helmet with regard to crash performance. This was achieved by careful attention to clearance over the head, by adequate anchorage of the helmet harness, and by proper stiffening of the shell to an extent that, although it will break in response to a heavy blow, its structural integrity is preserved so that it is capable of acting on the helmet harness and bringing it into play as quickly as possible. During production of the helmet, provisions were made for wind blast, acoustic attenuation, oxygen system, and visor. The visor, attached at either side, incorporates a g-operated device which automatically lowers the visor at between 10-12 g, thereby insuring that the visor is lowered by the time the subject emerges into the blast stream.

2088
Gazenko, O. G.,
and A. A. Giurdzhian
[FIXATION OF ANIMALS IN THE HERMETICALLY SEALED CABIN, TEXTILE "SUIT" AND LOCATION

OF PHYSIOLOGICAL SENSORS] Fiksatsiia zhivotnogo v germeticheskoi kabine, tkanevaia "odezhda" i raspolozhenie datchikov dlia registratsii fiziologicheskikh funktsii.—Problemy kosmicheskoi biologii (Moskva), 1: 336-344. 1962. In Russian, with English summary (p. 344).

A special "suit" made of fabric and consisting of two independent sections was fitted for dogs to provide room for attachments of instruments and of an excreta-collecting unit. The dogs were secured to the cabin walls by two pairs of chains. The respiration sensor was attached to the animal's chest, the potentiometric movement sensor to the back wall of the air-regeneration unit, and the arterial pressure sensors to the dog's collar. Techniques and devices were tested during a 20-day period, and used on the dog "Laika" in the Sputnik-2 flight. The article contains photographs and a diagram of various parts of the "suit".

2089
Golay, M.
[THE PRINCIPAL SAFETY DEVICES OF THE ASTRONAUT] Les principaux dispositifs de sécurité de l'astronaute.—Homme et l'espace (Lausanne), no. 13: 17-23. July 1962. In French.

The possible complications that may arise during the phases of pre-launching, launching, re-entry into the atmosphere, and landing may be due to either mechanical or human failings. Safety maneuvers and apparatus (parachutes, safety hatch, etc.) provided for the astronaut and the space capsule are outlined. Miscellaneous photographs are included.

2090
Gutfreund, K.
RESEARCH ON FOG-RESISTANT MATERIALS FOR HIGH-ALTITUDE HELMET VISORS.—Illinois Inst. of Technol. Armour Research Foundation, Chicago (Contract AF 33(616)-8076); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6301, Task no. 630104). Technical Documentary Report no. AMRL-TDR-62-141, Dec. 1962. vi+42p.

Various methods of preventing visibility losses due to fogging of plastic MA-3 and HGU-8/P helmet visors in pressure suits were investigated. Hygrophilic film-forming polymers with polyhydroxyl groups were found to be promising fog-resistant coatings. Their effectiveness depends largely on the relative surface concentration of hygrophilic and hygrophobic groups, since these groups determine the proper balance between wettability and stability of the treatment on prolonged and intermittent exposure on fog-promoting conditions. Visors treated with 83 to 87% hydrolyzed polyvinyl acetate showed good over-all optical properties. They exhibited little distortion, and their luminous transmittance and haze values were 92 and 0.4%, respectively. Enhancing the wettability of acrylic surfaces by ultraviolet irradiation and exposure in a thermal column of a nuclear reactor was ineffective. Also, preferential condensation of moisture in the helmet by gas-phase nucleation proved unsatisfactory for inhibiting fogging. (Author's abstract)

2091
Hendler, E.,
L. J. SantaMaria, N. Miller, and S. Greco
TEST INSTRUMENTATION REQUIREMENTS FOR BIOLOGICAL AIRBORNE AND ASTRONAUTICAL TEST: REQUEST FOR ACEL COPPER MANIKIN.—Cutler-Hammer, Inc. Airborne Instruments Lab., Deer Park, Long Island (Contract N156-40567); issued by Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Problem Assignment no. CO4AE13-2). Report no. NAEC-ACEL-491, July 22, 1963. vi+21 p.

An instrumented copper manikin is described for determining the thermal insulation value of clothing. The improved features of this device are pointed out and its performance under a variety of operating conditions is indicated. (Authors' abstract)

2092
Hinds, D. E.,
and J. Cleveland
CAPILLARY ACTION LIQUID OXYGEN CONVERTER FOR WEIGHTLESS ENVIRONMENT.—Bendix Corp. Pioneer-Central Division, Davenport, Iowa (Contract AF 33(616)-8185); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637302). Technical Documentary Report no. AMRL-TDR-63-10, Jan. 1963. iv+17 p.

A 25-liter, capillary-action liquid-oxygen converter was fabricated to incorporate all components required to provide a completely operational, self-contained system to supply breathing oxygen in a weightless environment. The converter design of functional components and the principle of operation has combined the forces of surface tension, wetting, and capillary action of liquid oxygen to provide adequate forces to insure satisfactory operation of the system in space environments. These forces will provide for the expulsion of liquid oxygen under standard conditions, during acceleration forces up to and including 14 g, and in the weightless condition. The test data and results of the complete development program and the physical arrangement required for the capillary action converter system are included. The testing which could be accomplished in the laboratory gave every evidence that the design concept is satisfactory for weightless operation. (Authors' abstract)

2093
Huxley, D.
TEXTILES AND CLOTHING FOR SPACE.—In: Proceedings of the Textile and Clothing Seminar (May 17-18, 1962), p. 47-62. Quartermaster Research and Engineering Center, Natick, Mass. Clothing and Organic Meterials Division. (Project no. 7-93-18-020). Technical Report no. TS-121, Sept. 1962.

The article summarizes the types of clothing which have provided protection for ground crews of the space program since 1947. The protection included that from fire, low temperature, high temperature, cryogenic liquids, routine liquid fuels, radio frequency hazards, and electrostatic charges. The development of one type of combination cold-weather survival and sleeping clothing to fit in a space of 350 cubic inches for conventional aircraft is also described.

2094

Jacquemin, C.

P. Varene, and J. Colin

[CONDITIONS OF MEASURING RESPIRATORY DEAD SPACE IN HEAD ENSEMBLES OF PRESSURIZED SUITS] Les conditions de mesure du volume mort respiratoire des ensembles de tête des vêtements pressurisés.—Revue de médecine aéronautique (Paris), 1 (3): 51-54. March-April 1962. In French.

Using various respiratory equations, techniques, and diagrams, an attempt is made to evaluate the effects of dead space in head ensembles of pressure suits. The experimental conditions were found to be too severe to yield a valid estimation of respiratory dead volume. However, the comfort of motor and sensory functions in the head was assured by a large spherical geometric volume. Respiratory dead volume was minimized by the mask. Two solutions are given for future experiments reconsidering the problems of respiratory dead space.

2095

Jethon, Z.

[THE EFFECT OF VARIABLE PRESSURE BREATHING WITH SIMULTANEOUS COMPENSATION BY A PRESSURE SUIT ON THE ARTERIAL AND VENOUS BLOOD PRESSURES] Wpływ skompensowanego nadciśnienia oddechowego zmiennego na zachowanie się ciśnienia tętniczego i żylnego. — Acta physiologica polonica (Warszawa), 13 (6): 823-835. 1962. In Polish, with English summary (p. 834).

A study was made of the arterial and venous pressures during variable pressure breathing with simultaneous compensation by a pressure suit. Cats under urethan anesthesia were used as subjects. Variable pressure breathing with simultaneous compensation was found to increase the arterial pressure without affecting the pulse pressure differential. Venous pressure increased less than during constant pressure breathing with compensation. The rate of respiration and the inspiration-expiration amplitude of the pressure applied did not affect perceptibly the behavior of arterial and venous pressures. Compensation of twice the required magnitude caused arterial pressure to stay at a higher level than did compensation of a magnitude equal to that of the pressure at the peak of inspiration. It is concluded from the results that with simultaneous compensation by a pressure suit, variable pressure breathing creates more favorable conditions for blood circulation than does constant pressure breathing. (Author's summary, modified)

2096

Kearney, J. B.

INVESTIGATION OF AUDIBLE NOISE IN AVIATORS' MINIATURE MASK MOUNTED OXYGEN BREATHING REGULATORS. — Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Problem Assignment no. C44AE22-32). Report no. NAMC-ACEL-469, March 5, 1962. [30] p.

An analysis of one-third octave band noise levels produced by aviators' miniature oxygen breathing mask-mounted regulators has been made. All current production model regulators produce noise levels equal to that of normal speech effort. One experimental model produced noise levels in the whisper level within the effective range of the Type ANB-MC-1 and M-94/A microphones which are currently used in the A13-A oxygen mask. Acceptable communication is possible with noise levels of this order. Specification requirements are recommended as a result of this study. (Author's abstract)

2097

Kissen, A. T.,

and J. F. Hall

PHYSIOLOGIC RESPONSE TO TRANSIENT HEAT STRESS IN REFLECTIVE VERSUS NONREFLECTIVE CLOTHING.—Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722204). Technical Documentary Report no. AMRL-TDR-63-79, Aug. 1963. iii+13 p.

Six subjects wearing either nonreflective or reflective outer garments of equal insulative value (1 clo) and unventilated were exposed in 96 experiments to heat pulses of 93°, 121°, 149°, and 177° C. for 15, 12, 9, and 2 minutes, respectively. The experiments were designed to simulate a range of re-entry heat exposures produced by malfunction or failure of the air-conditioning system of the vehicle. Total experimental time included the heat pulse and subsequent recovery period and was constant (40 minutes) for all conditions. Mean weighted skin and rectal temperatures, heart rate, total sweat produced and evaporated, and cardiac output, indirectly derived from blood pressure measurements, were the observed physiologic parameters. Evaluation of each parameter, individually, indicates that for some there is no relation between the physiologic response, the type of garment protection, and the level of thermal stress, while for others there is marginal benefit derived from wearing aluminized outer clothing. At only one time-intensity profile did the physiologic penalty of wearing nonreflective outer clothing appear more than marginal. However, even under the most severe conditions of thermal stress and absence of reflective protection, none of the physiologic responses approached tolerance limits in our terms of reference. The thermal protective effectiveness and practicality of the aluminized outer garment for intravehicular aerospace flights is also discussed. (Authors' abstract)

2098

Lent, C. P.

MOBILE SPACE SUIT. — U.S. Patent 3,034,131, May 15, 1962.

A high-altitude inflatable aviation suit is described and illustrated which is made of flexible material to withstand internal pressures and to flex freely. The neck section includes an attached air-tight helmet.

2099

Levantine, A. D.

COOLING GARMENT.—U. S. Patent 3,079,765, March 5, 1963.

A cooling arrangement for space suits is described and illustrated which includes a vacuum-tight double wall with liquid-absorbing material within, a liquid

reservoir communicating with the absorbing material, and valve means for selectively releasing vapor from absorbing material to the outside of the double wall.

2100
McCulloch, C.
THE ACCEPTANCE OF CONTACT LENSES IN MILITARY PERSONNEL. —— In: Visual problems in aviation medicine, p. 26-33. Ed. by A. Mercier. Oxford: Pergamon Press, 1962.

A group of 22 men fitted with contact lenses in October 1959 were followed up to March 1961. Seven subjects had discontinued wearing the lenses for various reasons (loss of lens, criticism at home, discomfort, irritation) and returned to wearing eyeglasses. The tendency to return to eyeglasses was prominent in persons that did not visit their optician regularly. Final ophthalmic check of 14 subjects revealed that all eyes were essentially healthy, but some had corneal edema and fine epithelial corneal erosions. Experiments with rabbits demonstrated that the corneal tissue in contact with the lens showed an increase in lactic acid content and a loss of coenzyme I. Wearing the lens for 12-18 hours did not change the quantity of carbon dioxide in the anterior chamber. Examination of the subjects in an altitude chamber showed the formation of gas bubbles under the contact lenses at high altitude (18,000-30,000 ft.). The bubbles were composed mainly of nitrogen. Grease and dirt were important in bubble formation. These bubbles were sufficient in number to cause visual disorders; they did not escape but remained in front of the cornea, obstructing the pupil. They did not disappear immediately upon return to ground level, and if the subject could not immediately clear his visual field it was necessary for him to remove his contact lenses.

2101
McFadden, E. B.
J. W. Raeke, and J. W. Young
AN IMPROVED METHOD FOR DETERMINING THE EFFICIENCY OF CREW AND PASSENGER OXYGEN MASKS. —— Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Oklahoma. Report no. 62-21, Nov. 1962. 16 p.

A method of determining oxygen mask leakage as developed under contract FA-885 between the Federal Aviation Agency and the Pioneer-Central Division of the Bendix Corporation is evaluated. Measurement of nitrogen concentration within an oxygen mask following respiratory nitrogen washout appears to provide a valid index of inboard mask leakage. Further development of this technique and its application to a proposed mask design is described. (Authors' abstract)

2102
Nixon, C. W.,
H. C. Sommer, and J. L. Cashin
USE OF THE AURAL REFLEX TO MEASURE EAR-PROTECTOR ATTENUATION IN HIGH-LEVEL SOUND [Abstract].—Jour. Acoust. Soc. America, 35 (5): 777-778. May 1963.

A technique of tympanomanometry developed for study of the aural reflex was adapted for use as an objective psychophysiological method for measuring attenuation of ear protectors in high-level sound. Four representative ear protectors (an insert, a semi-insert, a small-volume muff, and a large-volume muff) were evaluated by this aural-reflex method and by the ASA REAT method. Attenuation was designated in both instances as the mean difference between threshold values with and without ear protection (threshold shift). The aural reflex with ear protection was measured only for frequencies ranging from 400 to 4000 c.p.s., due to limitations of the signal source. A comparison of the results shows that for the frequency range used the aural-reflex threshold-shift method gives attenuation data comparing favorably with other above-threshold data. The absolute-detection threshold-shift method indicates somewhat greater attenuation than does the aural-reflex threshold shift, the differences varying both with the type of ear protector and as a function of frequency. The results suggest that a single-value correction factor for adjusting standard threshold-shift attenuation data to estimate attenuation in high-level sound may not be appropriate. (Authors' abstract)

2103
Orlova, T. A.
[THE EFFECT OF PERSONAL PROTECTORS ON THE FUNCTIONAL STATE OF THE NERVOUS SYSTEM IN PERSONS WORKING UNDER CONDITIONS OF HIGH NOISE LEVEL] Vliianie sredstv individual'noi zashchity na funktsional'noe sostoianie nervnoi sistemy u rabotaiushchikh v usloviiakh shuma. —— Gigiena truda i professional'nye zabolevaniia (Moskva), 6 (10): 39-45. Oct. 1962. In Russian, with English summary (p. 45).

Different types of protectors against noise, both external and internal are reviewed. Experimental data on the extent of protection afforded is presented in tables. It is pointed out that ear defenders are highly effective in preventing disturbances of the higher nervous activity, autonomic nervous system, and hearing acuity in individuals working under high noise levels. They are recommended as an integral part of the protective apparel used in industries with high noise levels.

2104
Pate, W. G.
OXYGEN MASK ASSEMBLY AND ADJUSTABLE SUSPENSION MEANS THEREFOR.—U. S. Patent 3,079,917, March 5, 1963.

An oxygen mask assembly adapted to be applied to an operator's face is diagrammed and described. It comprises in combination an oxygen mask, constraining device, strap for suspending mask adjacent to operator's face, etc.

2105
Peters, G. A.,
C. A. Mitchell, and Frank H. Smith
J-2 SPACE MAINTENANCE: PRELIMINARY STUDY. —— North American Aviation, Inc. Rocketdyne, Canoga Park, Calif. [Report no.] ROM 2181-1004. July 16, 1962. vii+36 p.

Two subjects wearing pressurized space suits performed two selected work tasks (removing and replacing oxidizer bypass ducts and gas generator spark plug assembly) on a J-2 engine during a preliminary investigation of space maintenance conducted at Rocketdyne June 18-22, 1962. The pressure suits were found to be uncomfortable and tiring after a work period of about an hour, and they greatly increased the complexity of, and time expended on, comparatively simple tasks. The results contain discussions on the design of space tools, pressure suit and glove limitations, component removal and replacement task difficulties, and supplemental environmental factors affecting job performance. Implications for further research are made in regard to problem areas which could be involved in the performance of space maintenance tasks on propulsion system equipment. (Authors' abstract, in part)

2106
Poe, R. H.,
E. T. Davidson, and G. Brieger
THE PHYSIOLOGICAL RESPONSES OF MEN WEARING CHEMICALLY IMPREGNATED PROTECTIVE CLOTHING IN A HOT DRY CLIMATE. —Military Med., 127 (5): 436-441. May 1962.
Previously issued as a report: Army Medical Research Lab., Fort Knox, Ky. (USAMRL Project no. 6X64-12-001). Report no. 507, Sept. 9, 1961. ii+8 p.

The rectal temperature, pulse rate, sweat output, and dermatological status of two groups of subjects, one wearing a protective uniform of Hycar Absorbent Protective Underwear and XXCC3 Impregnated Fatigues and the other standard long underwear and fatigue uniform, were contrasted while the subjects engaged in various types of physical activity in a hot dry climate. There was no difference between the groups. (Authors' summary)

2107
Polk, R. L.
SUBCRITICAL LIQUID OXYGEN STORAGE AND CONVERSION SYSTEM FOR OMNIGRAVIC OPERATION.—AiResearch Manufacturing Co., Los Angeles, Calif. (Contract AF 33 (616)-7153); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637302). Technical Documentary Report no. AMRL-TDR-62-143, Dec. 1962. vi+17 p.

An account is presented of the design and development of a subcritical liquid oxygen storage and conversion system for omnigravic operation. The system described differs from conventional methods as follows: (1) using a thermal shorting valve for providing heat to the storage vessel for liquid vaporization and maintaining system pressure; (2) an internal pressure regulating valve; (3) an internal heat exchanger for vaporization of any liquid state of the fluid prior to withdrawal from the vessel; and (4) a quantity gauge to measure the proportion of liquid in the remaining two-phase fluid in a zero-gravity environment. A description on component functions and heat transfer calculations are included.

2108
Rehman, I.
MULTI-DUTY HELMET. —— U. S. Patent 3,030,627, April 24, 1962.

A multi-purpose helmet is described and illustrated which is adapted to be fitted to the individual head. It is composed of both rigid concave and resilient flexible concave members.

2109
Reihm, H. D.
HELMET IMPACT TESTS. —— International Latex Corp., Dover, Del. (Contract AF 33(600)-39536); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6301, Task no. 630104). Technical Documentary Report no. MRL-TDR-62-19, April 1962. v+24 p.

Several helmets, designed and tested to determine which shell thickness and which type of suspension afford maximum protection during high-energy collisions and provide comfort during normal use, are discussed. There are many factors which influence the design of a satisfactory crash helmet; however, a combined analysis of three of its basic properties – reduction of acceleration, reduction of the rate of onset of acceleration, and the absorption of kinetic energy – is sufficient to reveal the relative performance of each helmet design. Tests which determine these basic properties are discussed. An analysis of the data correlated in graphical form shows an optimum helmet thickness and the most satisfactory suspension system of those studied. (Author's abstract)

2110
Ross, J. C.,
G. D. Ley, R. F. Coburn, J. L. Eller, and R. E. Forster
INFLUENCE OF PRESSURE SUIT INFLATION ON PULMONARY DIFFUSING CAPACITY IN MAN. —— Jour. Applied Physiol., 17 (2): 259-262. March 1962.

The present investigation was carried out using some of the same subjects and pressure suits in order to reconcile previous contradictory results. The earlier contradictory results were confirmed. The pressure suit used in one investigation (suit P) covered the entire body below the nipples, whereas the second suit (suit I) extended cephalad only as far as the costal margin. When suit P was inflated, the pulmonary diffusing capacity (D_L) again did not increase significantly in two subjects. However, when the upper part of the suit was folded down so that the thoracic cage was not covered, inflation of the suit did produce a significant increase in D_L. Inflation of suit P when it covered the chest made it difficult for a subject not to perform a Valsalva maneuver during breath holding and caused more decrease in alveolar volume than when it was inflated in the folded-down position. In two subjects studied, we found no difference in air trapping with inflation of suit P in the two positions. The discrepancy between the results of the two earlier studies appears to have resulted from the different construction of the two pressure suits used. We conclude that pressure suit inflation in man will produce an increase in D_L, presumably by means of pulmonary congestion. (Authors' abstract, modified)

2111
Scano, A.
[PRESSURE EQUIPMENT FOR ATMOSPHERIC AND SPACE FLIGHT] L'equipaggiamento a pressione per il volo atmosferico e spaziale.—Rivista di medicina aeronautica e spaziale (Roma), 26 (3): 478-508. July-Sept. 1963. In Italian, with English summary (p. 505).

The upper limit of human survival is at a barometric pressure of 90 mm. Hg (corresponding to an altitude of 15,000 m.) even in an atmosphere of pure oxygen. At a pressure of 47 mm. Hg (19,200 m.) the vapor pressure of water at body temperature is reached, which results in ebullition of body liquids. These difficulties can be overcome only by pressurization of either the aircraft cabin or of the protective suit. The development of pressure suits and their desirable properties are discussed in some detail: maintenance of a physiological oxygen pressure and adequate pressure on the body surface, disposal of carbon dioxide and other metabolic products exhaled or discharged through the skin, capability of temperature regulation, flexibility to permit movements of the head and extremities, etc. (37 references)

2112
Shepard, L. F.
OMNI-DIRECTIONAL HIGH ALTITUDE HELMET. — U. S. Patent 3,030,626, April 24, 1962.

A brief description and illustration are given of a helmet attached to a pressure suit used in high altitude flying. A rotatable pressure seal is included for maintaining pressure within the suit during movement of the helmet.

2113
Shepard, L. F.
PRESSURE SUIT FOR ALTITUDE FLYING. — U. S. Patent 3,042,926. July 10, 1962.

A ventilated pressure suit for high altitude flying which is adapted to enclose the body is described and illustrated.

2114
Spells, K. E.,
and O. J. Blunt
THE AIR-VENTILATED SUIT: EXPERIMENTS TO INVESTIGATE THE IMPROVEMENT IN THE THERMAL INSULATION DUE TO AIR FLOW THROUGH THE MATERIAL. — RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC no. 1201, Aug. 1962. i+64 p.

Measurements were made of the rate of heat flow from a large cylinder around which was fitted a ventilated jacket. The ventilating gas was supplied at the temperature of the cylinder (thermostatically controlled) and flowed radially outwards through the jacket material to produce the so-called dynamic insulation effect. Variables studied included air and carbon dioxide as ventilating gases, gas flow rate, and two jackets thicknesses. Temperatures of the external surface of the jacket were also determined for these conditions. Heat flow measurements were made only in experiments when cloths of different air permeability formed the external jacket surface. These latter experiments included some with a fabric having one face aluminized. The temperatures of the external jacket surface determined for different gas rates are consistent with the assumption, made in the extension of the theoretical work, that at this surface there operates the boundary condition of heat flux proportional to the temperature difference from ambient. A general conclusion, at least as regards the form of internal air distribution system investigated here, is that there should still be scope for improvement to equipment employing the principle of dynamic insulation for protection against either heat or cold. (From the authors' abstract)

2115
Turnour, N. C.,
and C. McCulloch
EYE PROTECTION IN AVIATION. — In: Visual problems in aviation medicine, p. 106-117. Ed. by A. Mercier. Oxford: Pergamon Press, 1962.

While spectacles, goggles, visors, and windows in helmets have all found useful roles in aviation, with each appliance certain problems remain. These center on the necessity to correct the ametropic aviator with the minimum of disturbance to vision, the minimum of equipment, and the maximum of dependability. In the matter of wearer acceptance, dependability, and safety, corneal type contact lenses were tested on 22 Royal Canadian Air Force subjects. Sixteen tolerated the lenses for various periods each day, three discontinued wearing them because of lack of motivation, one could not be satisfactorily fitted, and another was discharged from service prior to completion of the trials. Accidental loss of a lens often occurred. Included are tables of lens wearing times, various conditions under which the lenses were tried (decompression, decompression chamber, hot and cold chamber, acceleration, swimming, pressure, pressure chamber), and an appendix of the subjects' personal opinions about the lenses. The results indicate that the lenses are not considered safe for flying personnel if there were any significant periods of uncontrollable tearing or blurring, any frequency of a lens falling out, or incidence of a lens sliding into a fornix requiring manual maneuver for its recovery. Also the significance of the bubbles under the lens at altitude requires additional study before contact lenses can be acceptable.

2116
Varene, P.
Ch. Jacquemin, and J. Colin
[HOW TO DETERMINE THE FUNCTIONAL VALUE OF AN INHALATION MASK] Comment explorer la valeur fonctionnelle d'un masque d'inhalateur.—Revue de médecine aéronautique (Paris), 1 (3): 59-62. March-April 1962. In French.

Simultaneous measurements were made of mechanical impedance and respiratory gas exchange during the use of inhalation masks. The functional exploration of masks is of value in the rapid analysis of ventilated nitrogen, permitting evaluation of the mask's efficiency, measuring the static gas pressure at various breathing levels (i.e., mouth valve), measuring flow resistance, the mask's elasticity, and the degree of rebreathing. The physiological methods used for evaluation of marks are considered inadequate.

2117
Veghte, J. H.,
and W. W. Millard
ACCUMULATION OF STATIC ELECTRICITY ON ARCTIC CLOTHING.—Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238, Task no. 823801). Technical Documentary Report no. AAL-TDR-63-12, May 1963. iii+11 p.

Electrostatic voltages and capacitances on active men wearing various arctic clothing assemblies were measured at temperatures ranging from +5° to -43° C. Although there is an increase of electrostatic charges on arctic clothing assemblies with a decrease in ambient temperature, the stored energy calculations indicate there is no danger of igniting explosive gas-air mixtures due to a discharge of the electrostatic charges under normal conditions. A hazard may exist, however, if a person rapidly removes his outer jacket while working outside in a hazardous gas-air mixture. Also, a definite buildup of electrostatic charges above the critical threshold for igniting a concentrated gas-air mixture by an electrostatic discharge exists when a person working out-of-doors comes in and removes his parka or wool shirt without first properly grounding himself. (Authors' abstract)

2118
Webster, J. C.,
and E. R. Rubin
NOISE ATTENUATION OF EAR-PROTECTIVE DEVICES. —— Sound, 1 (5): 34-46. Sept.-Oct. 1962.

Five experienced listeners were tested on three separate trials using the binaural, absolute threshold-shift psychophysical method. Audiograms were taken first with open ears and then with various devices (ear plugs, muffs, helmets, and muff-earphone combinations). The results were compared with those obtained from other laboratories and with theoretical values of maximum attainable attenuations. The results indicate that a good fit with ear plugs is more difficult to obtain than with muffs. The Zwislocki resonant plugs were about 5 decibels better than the V-51R and COM-FIT plugs; the latter two plugs were nearly equivalent in attenuation. David Clark muffs gave more attenuation than Willson and Telephonics muffs, the latter giving the least attenuation. Attenuation of the Gentex DR51-4 flight helmet was not effective at low sound frequencies, giving no attenuation at frequencies below 250 c.p.s. The relative importance of headband force, volume and mass of the earcup, and the adverse effects of wearing eyeglasses under muffs are discussed. Included are representative figures, tables, and charts.

2119
Wilson, C. L.
PHYSIOLOGICAL PROTECTION OF THE CSU-4/P HIGH-ALTITUDE PRESSURE SUIT. —— Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 716404). Technical Documentary Report no. AMRL-TDR-62-112. Sept. 1962. iii+18 p.

The CSU-4/P high-altitude bladder pressure suit was designed mainly for quick donning. Each of 15 subjects who wore the suit ensemble was rapidly decompressed from 282 mm. Hg chamber pressure to 42 mm. Hg chamber pressure in an average of 1.5 seconds and then further to 33.6 mm. Hg. All subjects were able to remain at 33.6 mm. Hg for 5 minutes without any difficulty. Each of 14 of the subjects was again successfully exposed to the same profile except that one hand was bare and the other hand was protected by an unpressurized leather flying glove. Eight subjects were easily able to remain at 8 to 3 mm. Hg chamber pressure continuously for 120 minutes. One subject wore the CSU-4/P pressure suit ensemble during a special decompression study. (Author's abstract) (61 references)

c. Bailout and Bailout Equipment

2120
Bourret, M.,
A. Salvagniac, J. Fabre, and J. Divine
[PHYSIOLOGICAL STUDY OF A SONIC EJECTION WHICH HAD CAUSED SERIOUS INJURIES] Étude physiologique d'une éjection sonique ayant entrainé des lésions graves.—Revue de médecine aéronautique (Paris), 2 (8): 424-429. Aug.-Sept. 1963. In French.

The ejection from an aircraft at near sonic speed subjected both pilot and navigator to 16-17 g for 0.15 second. Both survived, but with numerous petechiae and serious injuries of the arms and legs, which are described. Following the ejection, it was determined that arm and leg harnesses should be added to the ejection seats E96 and E97. The petechiae were probably a result of deceleration, but the conclusion is not definite.

2121
Brodsky, R. F.
SPACE STATION ESCAPE VEHICLE. —— Institute of the Aerospace Sciences, New York, N. Y. IAS Paper no. 63-35, 1963.

Some aspects of the design for an emergency or "lifeboat-type" vehicle for lunar stations are described and discussed. The mission, over-all system description, and detailed design characteristics are included. Such vehicles might be used in the ultimate situation of structural or support function failure of the station. More routinely would be usage in cases where only one crew member might be sent back to Earth, as in cases of appendicitis or sickness in the crewman's earth-bound family, where it would not be practical to use multi-passenger shuttle craft.

2122
Fabre, J.,
and Y. Houdas
[CASE REPORT OF A SUBJECT HAVING UNDERGONE A SUPERSONIC EJECTION] A propos d'une observation d'un sujet ayant subi une éjection supersonique. —— Revue des Corps de santé des armées (Paris), 3 (2): 247-251. April 1962. In French.

This is the first French case, and the second or third known case, of ejection at supersonic speed (1,000-1,100 kilometers/hour) at an altitude of about 12,000 feet, in which the pilot survived. The pilot was comatose upon landing and his parachute torn during opening at high speed. Medical examination revealed left hemiplegia, right facial paralysis, and fracture of the 12th dorsal and 1st lumbar vertebrae. Coma persisted for 8 days; however, good psychomotor recovery followed. The origin of the disorders was attributed primarily to the effects of three factors: (1) blast, (2) deceleration, and (3) rotation of the seat and pilot.

2123
Fabre, J.,
and A. Pfister
[MEDICAL ASPECTS OF EJECTIONS AT VERY LOW ALTITUDE] Aspects médicaux des éjections à très basse altitude.—Revue de médecine aéronautique (Paris), 2 (7): 249-251. May-June 1963. In French.

Ejections at altitudes lower than 300 meters are usually fatal since a minimum of six seconds is required for the normal ejection sequences. The "0 second system" is described which reduces the ejection time to approximately four seconds and may be used when the altitude is lower than 1000 m. with a speed lower than 850 kilometers/hour. Since 1958, five ejections at less than 500 m. have been reported using this system, two successful and three failures (although not due to the 0 second system). The fact that the system is not automatic may be a disadvantage. Moreover, the danger of collision between the seat and parachute while opening, and improper separation of seat and pilot may interfere with operation of the system. These disadvantages are considered minor in view of the gain of two seconds in time more for 100 meters of free flight.

2124
Fitzgerald, J. G.,
M. L. Fisher, and A. J. Barwood
AN EXPERIMENTAL SYSTEM OF PRE-EJECTION BODY RESTRAINT.—RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). Report no. FPRC/Memo. 186, Aug. 1962. 13 p.

A pre-ejection body restraint system is described which appears to satisfy most, if not all, of the postulated physical requirements listed in this report. The system has the following advantages: (1) it is simple in concept and safe in operation; (2) it does not delay ejection since it uses a normal manual procedure; (3) full restraint is accomplished in less than 0.4 sec.; (4) spine, shoulders, and head are in good alignment for ejection; (5) individual sizing should not be necessary; (6) the entire system should not weigh more than 20-25 pounds; and (7) with practice, the six connections to the airman's clothing can be made in less than half a minute.

2125
Kittinger, J. W.
DISCUSSION OF PROJECT EXCELSIOR. —— In: Proceedings of the 2nd National conference on the peaceful uses of space, p. 249-255. Washington, D. C.: National Aeronautics and Space Administration, 1962.

Two basic objectives of Project Excelsior concern: (1) the physiological aspects of escape from high altitude and (2) the protection of man in a space environment. Excelsior balloon flights, I, II, and III are described as they relate to these two objectives. The first objective was realized when it was demonstrated that a man given the proper stabilization is afforded an escape means from altitudes in excess of 100,000 feet. The advantages and disadvantages of two basic ways of protecting men during extraneous trips from spacecraft are mentioned. These include a pressure suit designed to allow the freedom of movement needed and a powered capsule. Both are discussed with regard to safety and task performance as well as to the testing of them by means of balloon flights.

d. Survival and Rescue
(On Sea, Land, in Desert, Arctic, etc.)

2126
Barnett, P. W.
CONSIDERATION OF AIRCRAFT AS EMERGENCY SHELTERS. —— Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8242-1). Technical Documentary Report no. AAL-TDR-62-29, June 1962. iii+10 p.

This study was performed to determine the feasibility of use of a downed aircraft as an emergency shelter, and to investigate the possibility of improvision of a petroleum-burning stove. Profiles of temperatures of the occupied shelters, as well as of those with the improvised stove installed and operating, and of ambient temperatures are presented. Ambient temperatures range from -18° to -39° F. Pictures of the improvised stove and tools required in its construction are shown. The uninsulated, unheated aircraft is not adequate shelter for extreme cold environments. Stove improvision is practical. (Author's abstract)

2127
Campanale, R. P.
REALISM IN DISASTER EXERCISES—A TRUE CHALLENGE.—Military Med., 128 (5): 418-427. May 1963. DLC (RD1.A7, v. 128)

The experiences are reported with a disaster planning and training program at Travis Air Force Base Hospital. Training for all medical and paramedical personnel was provided by means of a simulated aircraft accident. The disaster team entered the compartment of the burning aircraft, rescued burned crew members, and treated casualties. Inertia and lack of initiative was observed at the disaster site on the part of most corpsmen and some medical officers, as well as a total lack of field leadership and supervision.

2128
DuBois, A. B.,
G. F. Bond, and K. E. Schaefer
ALVEOLAR GAS EXCHANGE DURING SUBMARINE ESCAPE.—Jour. Applied Physiol., 18 (3): 509-512. May 1963.

Alveolar gas samples were obtained before and at the end of buoyant ascent from a depth of 90 ft. of water. The partial pressure of alveolar carbon dioxide at the end was approximately equal to that at the beginning, as predicted, and the partial pressure of oxygen indicated that the arterial saturation would be almost normal. These findings indicate that buoyant ascents can be made from a depth of at least 90 ft. without breathing and without urgency to breathe. Extrapolation of these findings indicates that during ascents from much greater depths there should be little or no urgency to breathe. (From the authors' abstract)

2129
Macdonald, R.
SAFETY IN AIRLINE FLYING.—Canad. Air Line Pilot (Montreal), 19 (3): 10. Oct. 1963.

Because of rough terrain, airport fire fighting and rescue units cannot always proceed directly to the scene of an accident. To overcome this problem the Dynatrac vehicle has been produced. It is a fully tracked, articulated, high-mobility carrier which is capable of operating at high altitude in temperatures ranging from -65° to 115°F. under adverse environmental conditions.

2130
Rawlins, J. S. P.
A SYSTEM FOR ESCAPE FROM SUBMERGED AIRCRAFT.—Revue de médecine aéronautique (Paris), 1 (2): 197-200. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (2): 73-75. Feb. 1963.

The modifications made on a seat ejection system for escape from submerged aircraft, incorporating an automatic harness release system and automatic inflation of a personal dinghy, are described and evaluated. In the prototype form used in trials, automatic escapes were made from an aircraft fuselage from 40 feet, and from a simple A-frame from 100 feet depth. Before the system is introduced into service, it is necessary to devise methods to disconnect the parachute withdrawal line, and to insure that the firing gear in the breech of the gun is not withdrawn by the action of separation of the seat from the gun. At present the system is semiautomatic.

2131
Singer, R. C.
PREVENTIVE MEDICINE IN JUNGLE AND DESERT OPERATIONS.—Military Med., 128 (7): 641-645. July 1963.

A review is presented of the three physical environmental hazards (extreme temperature changes, high solar radiations, lack of water) to military personnel in desert operations. The preventive medicine problems in planning and executing special operations in the jungle and desert are discussed, along with the principal causes and prevention of disease casualties.

2132
Veghte, J. H.,
F. E. White, W. W. Millard, J. R. Schumann, and C. F. Kennedy
EVALUATION OF THE KC-135 AND U-2 BAILOUT SURVIVAL KIT.—Aerospace Medical Division. Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8238-01). Technical Note no. AAL TN-63-4, Feb. 1963. 15 p.

The bailout survival kits carried aboard the KC-135 and the U-2 aircraft were evaluated using four subjects, two of them Arctic survival experts, during an eight-day field trip conducted along Bear Creek near the Yukon River between Bald Mountain and Ruby, Alaska. The trip also afforded opportunity for subjects to determine hazards and problems of survival in the Arctic. The monitor of the test program was equipped with supplemental medical equipment, clothing, and food supplies in the event of an emergency. The clothing worn appeared to be inadequate to tolerate -35° to -40° F. weather without suitable shelter. The MC-1 sleeping bag proved very inadequate and it should be replaced by more appropriate insulative items or modified. In extreme cold, it appears that the first thing to do is to build an adequate shelter for the first night. All of the subjects thought they would put up a crude shelter the first night and improve it the following day. However, the first night is extremely critical, and once over the first or second nights, things should become easier. (Authors' summary, in part)

2133
Welling, C. G.
MAINTENANCE REQUIREMENTS. —— In: Space logistics engineering, p. 462-514. Ed. by Kenneth Brown and L. D. Ely. New York: John Wiley and Sons, 1962.

Maintenance in space logistics plays a significant role at all points in prelaunch and postlaunch time. Maintenance aspects are considered in the design stages. The problem areas of greatest importance are rendezvous, environmental control, and human factors. Several methods are proposed for soft landings on the moon and planets to avoid landing damage repairs. Return-to-base preparations after an extraterrestrial landing includes complete checkout for leaks, pressure, radiation damage, spacesuit checkout and maintenance, etc. Additional study is needed to develop emergency and escape methods for astronauts. Included are various representative figures and tables.

2134
Winchester, J. H.
AIR RESCUE ... TOMORROW SPACE RESCUE?—— Grumman Horizons (Grumman Aircraft Engineering Corp.), 1 (4): 22-27. Autumn 1962.

Over the next decade, Air Rescue Service will emphasize these major points: local base rescue helicopters with fire suppression kits and special crews; new recovery techniques and equipment such as air-to-air and surface pick-up systems; better airborne beacons and search equipment to be tied in with satellites; more versatility, range and speed for planes in search areas; better delivery through automatic systems of airborne survival gear; and space rescue study and development. While these goals are being achieved, the long-respected Grumman SA-16 Albatross will remain the workhorse of the Air Rescue Service.

e. Accidents and Accident Prevention

2135
Bruggink, G. M.,
and D. J. Schneider
LIMITS OF SEAT-BELT PROTECTION DURING CRASH DECELERATIONS.—Revue de médecine

aéronautique (Paris), 1 (2): 204-209. Dec. 1961-Jan. 1962. In English.
Also published in: Indus. Med. and Surg., 32 (1): 33-37. Jan. 1963.

Three crash injury investigations were analyzed to determine the critical region of human tolerance to seat-belt restraint. Static strength was not indicative of seat-belt behavior and strength under dynamic conditions. With respect to impact severity (magnitude and duration of peak deceleration), Case I (15-g belt) was probably the most severe, followed in order of decreasing severity by Case II (25-g belt) and Case III (15-g belt). It is postulated that a seat-belt restraint system with an energy-absorbing capacity of 25 g (occupant weight, 200 pounds) for a duration of at least 0.2 seconds forms a realistic compromise between the ideal and the practicable dynamic strength of such a system. Depending upon the physical condition of the belt user and the manner of belt adjustment, various degrees of decelerative injuries may be expected. However, these are preferable to the unpredictable exposure of the occupant who becomes a projectile. Protection offered by seat belt restraint is not limited by g factors but by the injurious aspects of the occupant's environment.

2136
Butz, J. S.
COLLISION PREVENTION THROUGH COLOR PATTERNS. — Flying, 70 (2): 30-31, 92, 94, 96. Feb. 1962.

The standardization of painting of civil aircraft is discussed as a means of avoiding aircraft collision accidents. A report is given of the tests being carried out by the Applied Psychology Corporation of Arlington, Virginia. These tests show that the top of the aircraft should have a highly reflective, light color, the underside a low reflective, dark color, that enamel paints are as effective as fluorescent paint at long range, and that large lettering serves to camouflage the airplane. Various economic problems of applying these results to the industry are discussed. A brief review of the history of air collisions is given, and various factors affecting visual sight of aircraft are discussed.

2137
Evrard, E.
[BLINKING OF THE EYES, POSSIBLE CAUSE OF AN AIRCRAFT ACCIDENT] Le clignement des yeux, cause possible d'accident aérien. — In: Visual problems in aviation medicine, p. 45-53. Ed. by A. Mercier. Oxford: Pergamon Press, 1962. In French, with English summary (p. 53).

The human factor may be responsible for accidents of landing and flight collisions. High-performance aircraft generally have high landing speeds (250-300 km. per hour). The precision exercised by the pilot during landing necessitates accurate vision. Involuntary blinking may cause errors in the rapid evaluation of conditions and lead to an accident. The blind period during blinking is estimated to be 0.55 second. At a speed of 300 km. per hour, 43 m. are covered during these 0.55 second. Blinking as a cause of accident ranks next after fatigue and inattentiveness. Measurement of the blinking frequency during the performance of complex sensory-motor tasks revealed continuous and significant fluctuations in the state of vigilance. Consideration is given to the screening value of the stipple test for pilot candidates presenting blinking.

2138
Fichtbauer, S.
PERCEPTION PROBLEMS IN HIGH-SPEED FLIGHT. — Revue de médecine aéronautique (Paris), 1 (4): 33-34. July-Aug. 1962. In English.
Also in: Vorträge der Mitarbeiter des Instituts für Flugmedizin der DVL in London und Paris (1960 und 1961). Deutsche Versuchsanstalt für Luft- und Raumfahrt E. V., Porz-Wahn/Rhld., Bericht no. 205, p. 122- 133. Oct. 1963. In English and German.

The chance that a pilot of a supersonic Mach-3 airliner, flying Visual Flight Rules, can prevent collision with other supersonic aircraft crossing his flight path depends upon the following factors: (1) the time for the act of perception, for judging flight attitude of the other aircraft, and for taking preventive action (at least 2-3 seconds); (2) the turning radius of Mach-3 speed convenient for passengers; (3) the maximum distance at which the pilot is able to discover another aircraft according to visual acuity; and (4) visibility at cruising level. Collision avoidance by means of visual observation of air space does not seem to be of sufficient reliability. Making a precise flight plan and improving navigation equipment are unsatisfactory aids to prevent critical situations in supersonic air traffic. The provision of anticollision warners of an adequate range in supersonic airliners is recommended.

2139
Goorney, A. B.
VISUAL DEFICIENCIES AS A CAUSE OF AIRCRAFT ACCIDENTS. — Revue de médecine aéronautique (Paris), 1 (4): 38-45. July-Aug. 1962. In English.

No evidence was demonstrated that reduced visual acuity, astigmatism, manifest hypermetropia, poor accommodation, or poor extrinsic eye muscle balance within the limits of the current Royal Air Force standards played a specific part in the causation of a group of over 200 aircraft accidents (1958-1960) especially selected because visual factors may have had some bearing on their causation. However, visual acuity of 6/12 or worse in one or both eyes was more than twice as prevalent in the two groups of pilot-error accidents (5.7% and 6.9%) than in the technical-defect accidents (2.4%). This study indicated that corrective flying spectacles cannot be issued with the assumption that they will be worn on all occasions when it is essential. Representative tables are included. (Author's conclusions, modified)

2140
Jackson, J. R.
POTENTIALLY DISABLING LESIONS IN AIRCREW: FINDINGS IN A SERIES OF FATAL AIRCRAFT ACCIDENTS. — Canad. Services Med. Jour. (Ottawa), 18 (3): 165-175. March 1962.

A review is presented of the literature dealing with investigations of fatal aircraft accidents where the autopsy findings indicated pre-existing disease in the aircrew, and the findings are tabulated. Pathological diagnosis included coronary arteriosclerosis, myocardial infarction, coronary thrombosis, myocarditis, viral pneumonitis, viral encephalitis, tuberculosis of the kidney, etc. The autopsies reviewed in some Royal Canadian Air Force and NATO accidents showed 15% of the pilots to be suffering from lesions which, if detected, may have been considered grounds for temporary or permanent limitation of flying activity. In 3 of 92 cases, illness may have contributed to the accident or to the death of the pilot, and another 3 cases provide grounds for suspicion. In 3 other cases in which coronary stenoses, severe isolated interstitial myocarditis, and viral encephalitis were discovered, the accidents were clearly shown to be due to unrelated causes. There is no evidence that the incidence of disease in the aircrew is higher than that found in any series of traumatic deaths, but its significance in this segment of the population is enhanced by the hazard it may present to life and property. (20 references)

2141
Lomonaco, T.,
A. Scano, and G. Paolucci
[STATISTICAL INVESTIGATION OF FLIGHT ACCIDENTS OF MILITARY AIRCRAFT WHICH OCCURRED IN ITALY IN 1947-61] Indagine statistica sugli incidenti di volo di aeroplani militari avvenuti in Italia dal 1947 al 1961.—Rivista di medicina aeronautica e spaziale (Roma), 26 (3): 404-409. In Italian, with English summary (p. 408).

Military aircraft accidents in Italy decreased from 1947 to 1961 if expressed in the number of flight hours. This decrease was quite regular for propeller planes, less regular for jet planes and helicopters. Among the causes of the accidents, human factors increased 63.75% (vs. 60.8% in civil aviation), probably on account of the increasing fitness requirements for piloting modern planes. A comparison of the injuries sustained in the accidents showed that jet plane accidents result in more severe lesions than do accidents of propeller planes or helicopters. An analysis is presented of the distribution of the injuries by the parts of the body affected (head, trunk, upper and lower extremities, and multiple lesions).

2142
Mason, J. K.
AVIATION ACCIDENT PATHOLOGY: A STUDY OF FATALITIES.—xvi + 358 p. London: Butterworth & Co., 1962.

A detailed analysis is given of the causes and effects of aircraft accidents, particularly those that resulted in deaths, based to a great extent on the author's experience in the Department of Aviation Pathology of the Royal Air Force. Injuries sustained during bailout, causes of death, and human and environmental factors which caused the accidents are discussed. Separate chapters deal with the reconstruction of accidents and fatal ejection attempts. A bibliography of about 760 references is appended.

2143
Platt, D. S.,
and F. M. Townsend
THE FUNCTION OF THE PATHOLOGIST IN AIRCRAFT ACCIDENTS.—Jour. of Trauma, 3 (4): 312-316. July 1963.

The aviation pathologist acts as consultant to the Civil Aeronautics Board and the Federal Aviation Agency by performing autopsies on aircraft accident casualties, by correlating injuries with other finds of aircraft boards, and by making appropriate recommendations to improve in-flight safety and to enhance the probability of survival in a catastrophe. Two cases are reported to illustrate the human, environmental, and traumatic factors confronting the aerospace pathologist. One involves a 63-year old pilot whose postmortem examination revealed nitroglycerin tablets in the pocket, and the other a dynamite explosion aboard a commercial jet airliner carrying 45 persons.

2144
Ramsden, J. M.
WORLD AIR SAFETY.—Flight (London), 83 (2829): 775-780. May 30, 1963.

Various aspects of the accident records of air crashes involving one or more fatalities in 15 countries since Jan. 1, 1953 are discussed and analyzed. Each country is listed separately, and the number of fatalities and the circumstances of each accident are given. From those factors analyzed it is concluded that world's safest air transport countries are Australia, Scandinavia (Denmark, Norway, and Sweden), and the U. S. A. in that order.

2145
Reals, W. J.,
and R. E. Danielson
FLIGHT FATALITIES STUDIED: AUTOPSY INVESTIGATION OF AIRCRAFT ACCIDENTS.—Jour. Kansas Med. Soc., 64 (8): 354-357. Aug. 1963.

Two accidents are presented to illustrate methods. In accident number 1 only a portion of the passengers were killed since the incident took place after landing. Some did not escape probably due to smoke and asphyxia and not to injury. In accident number 2 the aircraft crashed shortly after take-off and was a high-velocity, steep-angle crash killing crew and passengers instantly. In this case examination ruled out fire aloft and pointed towards other factors to help explain the accident. Problems encountered in both types of accidents are discussed. Suggestions for on-the-scene organization are presented as well as an outline of needed equipment and supplies. Finally, it is attempted to alert the physicians who have an interest in aviation, either as pilots or examiners, of the need for complete inquiry—including autopsies—in all fatal aircraft accidents. (Authors' summary)

2146
Robinson, J. E.,
and K. G. Cook
A FLIGHT SIMULATOR TEST OF AN ALTITUDE-CODED AIRCRAFT LIGHT. — Jour. Engineering Psychol., 2 (1): 15-21. Jan. 1963.

To obtain an estimate of the usefulness of an altitude-coded light system as a nighttime visual collision avoidance aid, six pilots made judgments of relative altitude and vertical flight path of a simulated target aircraft. Flashing light signals were presented using a modified F-100/151 flight simulator and aerial gunnery trainer. Subjects were tested with pre-arranged problems involving three rates of altitude change and a number of collision courses and vertical misses. Accuracy of determining the vertical flight path was considerably better with an altitude-coded light, using dot-dash signals learned in advance, than with an uncoded light of fixed-frequency flash rate. Altitude coding also yielded more accurate judgments of target relative altitude, although the advantage was not as pronounced. For both coded and uncoded lights, faster rates of altitude change of the target aircraft yielded less accurate judgments of relative altitude, and more accurate judgments of the vertical flight path. (From the authors' summary and conclusions)

2147
Siegel, A. I.,
and R. S. Lanterman
AIRCRAFT DETECTABILITY AND VISIBILITY. VI. A QUALITATIVE REVIEW AND ANALYSIS OF THE UTILITY OF FLUORESCENT PAINT FOR INCREASING AIRCRAFT DETECTABILITY AND CONSPICUITY.—Applied Psychological Services, Wayne, Pa. (Contract N156-38581); issued by Naval Air Material Center, Air Crew Equipment Lab., Philadelphia, Pa. Report no. NAEC-ACEL-492, March 4, 1963. iv+54 p.

Both pilot opinion and recent basic and applied studies of fluorescent paint are considered. The pilot opinion sampled supported the use of fluorescent paint for increasing aircraft conspicuity and detectability. Although not all the basic and applied studies of fluorescent paint reviewed indicated self-consistent findings, the use of fluorescent paint for increasing aircraft conspicuity and detectability also seemed indicated by these studies. A series of recommendations on fluorescent paint application is presented. (Authors' abstract)

2148
Smith, Alan E.
NOW 5,000,000 JET HOURS.—Flight (London), 83 (2829): 781-783. May 30, 1963.

The worldwide record of the jet airliner safety record covering the first five million hours of flight time is compared and analyzed. The dates of all known jet accidents from Feb. 2, 1959, to Feb. 20, 1963, are given along with number of fatalities and cause of the accident. In regard to fatalities per million flight hours, the jet period is three times worse than the pre-jet period. Most of the jet accidents have occurred during landing and show an accident rate of 2.5 per 100,000 landings.

2149
Swearingen, J. J.,
and S. R. Mohler
SONOTROPIC EFFECTS OF COMMERCIAL AIR TRANSPORT SOUND ON BIRDS. — Federal Aviation Agency. Civil Aeromedical Inst., Oklahoma City, Oklahoma. Report no. 62-4, March 1962. 5 p.

The Electra sound spectrum contains an audible chirp which appears identical in frequency and wave form to the chirp of field crickets. Field observations strongly indicate that the sound of the taxiing Electra exerts an attraction for starlings, and possibly other birds, particularly in the fall in the Northeast, when insects suddenly become less plentiful. The implications of this attraction, "positive sonotropism", for air safety, are discussed. Recommended approaches to alleviating this type of bird hazard are presented. (Authors' abstract)

2150
Thalang, S. N.
[HUMAN FACTORS AS CAUSE OF AIRCRAFT ACCIDENTS]. — Royal Thai Air Force Medical Gazette (Bangkok), 11 (2): 99-103. April 1962. In Thai, with English section headings.

Hypoxia, disorientation, and decompression sickness which may affect the pilot during flight are discussed in relation to their role in causing aircraft accidents. Consideration is given to the importance of proper flight planning prior to takeoff, and to the rules governing visual and instrument flight in the prevention of accidents.

2151
Townsend, F. M.,
and A. M. Dominguez
UTILIZATION OF TOXICOLOGY IN AIRCRAFT ACCIDENT PREVENTION. — Revue de médecine aéronautique (Paris), 1 (4): 11-12. July-Aug. 1962. In English.

The major endeavor of the Armed Forces Institute of Pathology's Toxicology Laboratory in the medical investigation of aircraft accidents is in the area of evaluating the causative environmental conditions (altitude hypoxia, toxins). Toxicological findings are of value when used in conjunction with other evidence in reconstructing the events leading up to an accident. Considerable effort is devoted to the isolation and identification of drugs present in tissues of fatalities and to postmortem evidence of acute hypoxia as well as detection of carbon monoxide in the blood of accident victims. Frozen tissues are routinely examined for the presence of ethyl alcohol. Studies are underway on the distribution of gases (oxygen, nitrogen, carbon dioxide) in body tissues and fluids under various experimental conditions.

2152
Townsend, F. M.
PROBLEMS ARISING FROM HIGH-SPEED TRANSPORTATION.—Military Med., 128 (5): 378-383. May 1963.

A pathological study of 3,500 cases resulting from aircraft accidents received and studied by the Armed Forces Institute of Pathology (AFIP) establishes three factors that affect man and the aircraft. These are: environmental factors (low oxygen tension and barometric pressure, temperature extremes, fire hazards, etc.); traumatic factors, which involve function or lack of function of personal equipment, deceleration stress from ejection from aircraft, or during an abnormal situation without the proper runway or aid of an airport; and pre-existing disease in aircrews, which may cause accidents. In many cases combined engineering and medical investigation of an aircraft accident leads to determination of the accident's causes. Development of the standard shoulder harness and lap belt, capsule-type ejection equipment, and other protective equipment has saved the lives of many flying personnel operating high-performance aircraft. The important phases of the activities of AFIP is the continuing study of pathological changes in aircrew members. To date no adverse effects on the human body have been proved to be caused by flying.

2153
Trumbull, R.
PILOT ERROR. —— Naval Research Reviews (Washington), 1962 (June): 10-14.

In view of the remarkable advances made in aircraft design, it seems paradoxical that accidents occur because of pilot error, even in perfect flying weather. These may take place when the pilot becomes oblivious to stimuli which he actually receives if he anticipates a certain outcome of events to which the stimuli apply. For the pilot to remain alert, he must be subjected to changing stimuli. Over-reliance upon instruments also contributes to the premature closing of psychological channels. Accidents could be avoided if the pilot's working conditions were not so good, as when the weather is marginal rather than perfect, forcing the pilot to give more attention to his task.

2154
Tweedie, P. G.
INVESTIGATING AIR ACCIDENTS. —— New Scientist (London), 17 (321): 83-85. Jan. 10, 1963.

The qualifications and organization of air accident investigating personnel are described. Investigative procedures include steps taken from the beginning of an accident to the formation of an opinion of a likely cause. The modern aircraft is now a very large and complicated but easily disintegrated structure, propelled at extremely high speeds at great altitude and controlled by advanced hydraulic and electrical systems. Communication between it and the ground is at a minimum. Consequently, many of the methods devised and used by investigators over the years to faciltate determining accident causation can no longer be applied. Effective accident investigation must depend increasingly upon an analysis of flight information obtained from automatic recorders carried on the aircraft itself. Such recorders, protected against fire and the forces of impact, are designed to be recovered with the recordings intact.

2155
Ugedo Abril, J.,
and F. J. Garcia Condé
[PSYCHOLOGICAL ASPECTS OF THE AIRCRAFT ACCIDENT] Aspects psychologiques de l'accident aérien.—Revue de médecine aéronautique (Paris), 1 (3): 21-22. March-April 1962. In French.

Two cases are reported of minor aircraft accidents attributed to psychological factors. One case involved the pilot's apprehension over the birth of a son with a congenital abnormality, and the other the pilot's anxiety over improving his socio-economic status. Psychological factors modify the pilot's efficiency and flight safety.

2156
Vorel, F.
SOME NOTES ON THE SIGNIFICANCE OF THE LACTIC ACID LEVEL IN BRAIN TISSUE AT THE MEDICO-LEGAL EXAMINATION OF AIR CRASHES. —— Rivista di medicina aeronautica e spaziale (Roma), 25 (4): 636-640. Oct.-Dec. 1962. In English.

Postmortem brain lactic acid levels were investigated and an equation set up from the examination of fatal traffic injuries. Consideration was given to the time elapsed between death and sampling of material, and to whether or not death occurred immediately due to injury or some time later. Cases with injury survival were represented by a group having a hyperglycemic reaction. An elevated level of 200 mg. 1.00 cc. of lactic acid may be found when more than 20 hours have elapsed between death and sampling of material. Cases with lactic acid levels over 200 mg. 1100 cc. could not be evaluated as due to hypoxia, or as a hyperglycemic reaction. Various studies showing hyperglycemia to be a precursor of elevated lactic acid levels in cases of altitude hypoxia are briefly reviewed.

f. Interplanetary Contamination

[Contamination of Aircraft under 8-g]

2157
[BIOLOGICAL DANGERS OF SPACE FLIGHT] Biologische Gefahren der Raumfahrt. —— Weltraumfahrt (Frankfurt), 13 (2): 50. March 1962. In German.

A brief editorial describes the dangers that may arise for life on earth upon return of a space ship contaminated with extraterrestrial organisms. Effective decontamination procedures should be developed before space travel and carried out before launching the space vehicle to prevent passage of terrestrial organisms into space and before reentry. A model of such a sterilization plant has been built and tested, employing as the chemical agent a mixture of ethylene oxide and freon-12 gases. Other methods include ultrasound, irradiation, dry heat, chemical disinfection, extreme cold, dehydration, and mechanical abrasives.

2158
Hobby, G. L.
STERILIZATION OF SPACECRAFT.—Proceedings of the Lunar and Planetary Exploration Colloquium, 3 (2): 49-51; discussion, p. 51-52. May 5, 1963.

The actual damage from biological contamination of the moon would appear to be extremely low but can be fully evaluated only after data are obtained from soft-landed probes. Moreover, the strongest argument in favor of spacecraft sterilization is the uncertainty of any current predictions regarding the lunar environment. Therefore, vigorous sterilization techniques have been, and are being, developed for all lunar and planetary exploration vehicles. The methods employed for decontaminating lunar spacecraft include dry-heat sterilization of components and subassemblies whenever possible and the use of sterile assembly procedures. Ethylene oxide is employed for decontamination of the surface of the spacecraft, which is enveloped in a specially designed shroud. Although these procedures are considered effective for lunar missions, more stringent methods are contemplated for Mars spacecraft. (Author's abstract)

2159
Imshenetskii, A. A.
PERSPECTIVES FOR THE DEVELOPMENT OF EXOBIOLOGY.—In: Life sciences and space research, p. 2-15. Ed. by R. B. Livingston and others. Amsterdam: North-Holland Publishing Co., 1963.

The sterilization of space ships is of paramount importance for further exobiological investigations because microbes will not completely perish on the space-ship surface. In searching for microorganisms on other planets and in interplanetary space the greatest danger is that, as a result of errors in technique, the investigator may detect earthly microorganisms which have invaded and reproduced in the nutrient medium used. Initially, search for heterotrophic bacteria should be carried out, then phototrophic, denitrifying, sulfate-reducing, nitrogen-fixing microorganisms, as well as bacteria oxydizing sulfur, iron, methane, and hydrogen. Studies of the possible conditions to which life would be exposed in space are possible on earth. These studies include investigations of the influence of low and high temperatures, vacuum, and radiation on living cells. Instruments for detection of cosmobionts can be based on nephelometry, potentiometry, manometry, and on the use of carbon-labeled compounds added to the nutrient medium. (From the author's abstract)

2160
Jaffe, L. D.
STERILIZATION OF UNMANNED PLANETARY AND LUNAR SPACE VEHICLES: AN ENGINEERING EXAMINATION.—Calif. Inst. of Technology, Pasadena (Contract NAS 7-100). JPL Technical Report no. 32-325 (Revised), March 25, 1963. iv+18 p.

The probability of achieving and maintaining sterility of an unmanned spacecraft with various proposed procedures is examined in detail. The required degree of assurance against infection of a planet with Earth organisms is also considered. For Mars landers and orbiters, sterilization by dry heat, with no subsequent access to the spacecraft, is found to be desirable. Glove box sterile assembly is not recommended for these missions; sterile assembly in a hood or in the open seems wholly unsatisfactory. For Venus landers and orbiters, sterilization standards can be somewhat relaxed; for the Moon, sterilization appears unnecessary, but microbial counts should be kept low. Sterilization lowers spacecraft and system reliability. It reduces the chance of launching within periods fixed by astronomical constraints, and increases costs. The gain which should be achieved by spacecraft sterilization (in return of significant biological data on the planets) must be balanced against these losses. (Author's abstract) (40 references)

2161
Jaffe, L. D.
STERILIZING UNMANNED SPACECRAFT.—Astronautics and Aerospace Eng., 1 (7): 22-29. Aug. 1963.

An entry capsule or lander for Mars should be sterilized and handled with procedures assuring that the probability of a single viable organism being aboard is not over 10^{-4}. To achieve this probability, heat sterilization of the lander is recommended, either in space or in the final sealed container, with no access permitted or mechanically possible thereafter unless followed by complete heat resterilization. If heat sterilization of the lander is impossible, then heat sterilization should be used on as large an assembly as possible and sterile parts, including fluids, added by a glove box procedure using ethylene oxide in the box. Sterilization is required for all parts, tools, assembly engineers, and Mars orbiters. For Mars and Venus flyby spacecraft, for Venus orbiters, and for the last stages of launch vehicles, either sterilization should be used, or trajectories controlled to ensure not over 10^{-4} probability of hitting Mars and 10^{-1} probability of hitting Venus. For lunar missions, sterilization does not seem essential. Cleanliness procedures are necessary to assure that no more than 0.01 gram of living matter is deposited on the Moon per flight. (Author's conclusions, modified) (54 references)

2162
Lovell, B.
THE CHALLENGE OF SPACE RESEARCH. — Nature (London), 195 (4845): 935-939. Sept. 8, 1962.

A brief discussion is given of the possibilities of discovering life outside the Solar System, and the importance of this discovery to the study of biology. A warning is issued to the U.S. and the U.S.S.R. to not let national pride cause contamination of Mars and Venus by letting unsterile rockets crash on the surface of these planets. Before impacts are attempted the situation should be evaluated by studies carried out at safe distances from the planets.

2163
Nicks, O. W.,
and O. E. Reynolds
DECONTAMINATION AND STERILIZATION OF LUNAR AND PLANETARY SPACECRAFT.—Science, (Washington), 142 (3592): 539-540. Nov. 1, 1963.

A review is presented of the establishment of procedures for the decontamination of the Ranger spacecraft. The procedures incorporating sterilization by heat and ethylene oxide are outlined, and these methods are believed to be most stringent. Many profitable results were gained from this program, but difficulties were also encountered. The problems of sterilizing some of the more delicate equipment may have contributed directly to Ranger failures. It is recognized that decontamination must be considered in all design phases. Changes in procedures have been made for the eventual landing on the Moon, and methods for sterilizing spacecraft for the Mars program are briefly stated.

11. MAN-MACHINE INTEGRATION AND LIFE-SUPPORT SYSTEMS

a. General

2164
Balke, B.
HUMAN TOLERANCES.—Federal Aviation Agency, Civil Aeromedical Research Inst., Oklahoma City, Oklahoma. Report no. 62-6, April 1962. 15 p.

The ultimate limitations in flight performance and in future civil air carrier equipment are the limitations imposed by what may be termed "human tolerances". This is particularly applicable to the matter of the supersonic transport. The discussion of man's maximum adaptive capacities for the majority of stresses potentially encountered in atmospheric and transatmospheric flights points to the weakest links in the man-machine complex of air and space transportation. An attempt is made to point out the means by which the human tolerances can be maximally adapted to the advanced technology. (Author's abstract)

2165
Brandon, H. J.,
and L. Sawamura
GEMINI'S ENVIRONMENTAL CONTROL.—Space/Aeronautics, 40 (1): 88-93. July 1963.

The environmental control system for Gemini spacecraft is one that maintains a safe and comfortable gaseous atmosphere for the astronauts, providing fresh oxygen, cabin and suit pressurization, and temperature, and handling the removal of water and toxic gases. In addition, the system provides equipment cooling and temperature regulation for the vehicle's fuel cells. Description and illustrations of the component parts are presented.

2166
Brown, W. R.
THE ROLE OF MAN IN THE CHECKOUT LOOP.—Missiles and Space, 11 (4): 18-21. May-June 1963.

An audio technique for programming equipment and operators through test sequences is described. The procedure attempts to achieve the benefits of automatic operation to the greatest possible extent while retaining the human operator in the checkout loop as a prime decision-making element, exercising those factors of judgment which are not readily adaptable to computer programming in automated systems. Audio programming features the following: (1) a simple method for defining operator participation in a test sequence; (2) a method for testing or calibrating systems which have no access to automatic equipment; (3) significant time saving; (4) inexpensive equipment in comparison with that of more automatic systems; and (5) easy integration into a larger, more complex, computer system to provide operator programming without detracting from the necessary high-speed-test features of the computer programmer.

2167
Denisov, V. G.
[SOME ASPECTS OF THE MAN-MACHINE PROBLEM IN COMPLEX CONTROL SYSTEMS] Nekotorye aspekty problemy sochetaniia cheloveka i mashiny v slozhnykh sistemakh upravleniia.—Problemy kosmicheskoi biologii (Moskva), 2: 54-67. 1962. In Russian, with English summary (p. 66-7).

English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 56-71. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

General requirements are given for indicators and signal devices of complex man-machine systems. The aim of such devices is an optimal combination of human "characteristics" with control instrumentation. The question is raised of the necessity of dividing the information given by indicators into quantitative and qualitative aspects, the latter of which allows a reduction of information coding and decoding time, and a limitation of demands on the operator's memory, and thus shortens his training period. It is suggested that V. A. Kotelnikov's theorem be applied to systems for information transmission requiring minimal use of apparatus for flight control. The control system has to include devices for coding and decoding the primary information and transmitting it in the generalized form that requires only elementary actions on the operator's part.

2168
Diringshofen, [H.] von
[IMPORTANCE OF THE HUMAN FACTOR FOR THE CONTROL OF AIR TRAFFIC IN VIEW OF CURRENT FLIGHT SAFETY] L'importance du facteur humain pour le contrôle du trafic aérien en vue de la sécurité en vol d'aujourd'hui.—Revue de médecine aéronautique (Paris), 1 (3): 30-31. March-April 1962. In French.

By evaluating the working areas and general physiopsychological problems of air traffic controllers, the flight surgeon may improve his work efficiency. From the standpoint of human engineering, evaluation of the work area may reveal the following: (1) unfavorable lighting conditions in the control rooms, reflections of troublesome light from bright signal lamps around radar screens, or too bright or too dark work areas; (2) excessive noise produced by conversation in control rooms; and (3) insufficient or faulty air-conditioning. These factors are the greatest cause of irritation and fatigue in air traffic controllers. The flight surgeon may suggest that the number of uninterrupted work hours for radar pilots be revised in the interests of flight safety, that the air traffic control service adapt optimum conditions for work areas based on the needs of their personnel, and where human limitations are evident they be replaced by automation or improved technical facilities.

2169
Feallock, J. B.,
and G. E. Briggs
A MULTIMAN-MACHINE SYSTEM SIMULATION FACILITY AND RELATED RESEARCH ON INFORMATION-PROCESSING AND DECISION-MAKING TASKS.—Ohio State Univ. Lab. of Aviation Psychology, Columbus (Contract AF 33(616)-7122); issued by Aerospace Medical Division. Behavioral

Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718403). Technical Documentary Report no. AMRL-TDR-63-48, June 1963. 10+139 p.

This report describes (a) the development of Comcon, a general-purpose simulation facility for research on information processing in multi-man systems; and (b) four developmental and three substantive system studies conducted on IPAC, a small-scale multiman systems simulator. Also, brief summaries are given (c) for nine studies of individual performance and information-processing and decision-making tasks; and (d) for a paper which discusses concepts and methods found to be useful in systems research. (Authors' abstract) (33 references)

2170
Fitts, P. M.
FUNCTIONS OF MAN IN COMPLEX SYSTEMS. — Aerospace Engin., 21 (1): 34-39. Jan. 1962.

The questions concerning the most effective use of man in complex man-machine systems are resolved to: (1) whether or not man will do an adequate job at less cost, weight, power, smaller failure rate, and lesser maintenance; (2) what functions or roles man prefers or accepts in the system design; and (3) what allocation of functions between man and machines is best from a system's viewpoint. Information gained from research on human limitations and human capacities is discussed. Some of the unique abilities of man viewed as a systems component include his versatility, capacity for adaptation and learning, ability to interchange speed for accuracy, relative reliability in regard to performance, judgment, perceptual capacities, ability to make decisions in the face of unreliable information, and ability to employ heuristic methods in decision making and contingent programming. Implications for system design in manned space vehicles are discussed.

2171
Freed, A. M.
HUMAN INTERACTIONS IN MAN-MACHINE SYSTEMS.—Human Factors, 4 (6): 389-396. Dec. 1962.

Human interactions play a vital role in the reliability of man-machine systems. Techniques are necessary to insure that those which occur do so because they are so designed and planned. A tentative approach to providing lists of such interactions, and ways of defining, labeling and measuring them are suggested as basic to design input. Methods for isolating units of interactive behavior are proposed and samples of system behavior and their respective activities described in terms of actions and reactions. The need for definition and labeling of activities couched in operational terms is emphasized in the interest of design, training, and measurement of human interactions in man-machine systems. Techniques for accomplishing these steps are suggested. (Author's abstract)

2172
Gilruth, R. R.,
and L. N. McMillion
MAN'S ROLE IN APOLLO. — Institute of the Aerospace Sciences, New York, N. Y. IAS Paper no. 62-187, 1962. [19] p. (Presented at the IAS Man-machine competition meeting, Seattle, Washington, Aug. 10-11, 1962).

Manned landing on the moon and return to earth within this decade is a major national objective. Accomplishment of this objective is the purpose of Project Apollo. The Apollo spacecraft is being designed to utilize the capabilities of the crew and various automatic systems. The discussion of selected mission phases illustrates the close interaction between the crew and the spacecraft systems. Man's role in Apollo is, therefore, the efficient use of his own talents and those of the systems at his disposal. (Authors' summary)

2173
Gonon, J. P.
BIBLIOGRAPHY OF HUMAN FACTORS RESEARCH WITH ABSTRACTS, 1954 THROUGH 1962.—Electronic Systems Division. Decision Sciences Lab., L. G. Hanscom Field, Bedford, Mass. Technical Documentary Report no. ESD-TDR-63-603, Aug. 1963. iv+109 p.

This bibliography contains unclassified abstracts of selected Technical Documentary Reports issued by the Decision Sciences Laboratory, Electronics System Division, Air Force Systems Command, during 1954 through 1962. The major areas comprising the Laboratory's mission are the performance of behavioral science research, development, and testing to advance command and control system technology, and the implementation of research findings to improve the design and performance of Command and Control Systems. The bibliography contains three indices, cross-referencing the reports by author, by organization, and by specialized categories: (1) Statistics, Measurements and Methods, (2) Psychophysical Research (Audition and Vision), (3) Perception and Cognition, (4) Learning and Training, (5) Group Processes, (6) Psycholinguistics, (7) Systems Research (Design and Analysis, Human Engineering, Personnel, Test and Evaluation, Training), (8) Bibliographies, Handbooks, and Indexes, and (9) Equipment. (Author's abstract) (370 references)

2174
Hanson, C. M.,
and C. A. Gilbert
LABORATORY IN SPACE.—Mechanical Eng., 85 (11): 56-60. Nov. 1963.

The manned space laboratory is designed primarily to determine the limits of man's effectiveness in space. Among the answers obtainable through its use are the following: (1) can man live and perform tasks in a weightless condition for long periods of time without a degradation of his performance? (2) If artificial gravity is required, must the station be rotated continuously? (3) If this is required, what is the optimum level of artificial gravity? (4) What can be expected of a large crew? (5) What are the requirements for efficient logistic support operations? A typical preliminary design of the first small station to be developed as a manned space laboratory is discussed, including guidelines; conversion of a tank to laboratory; power, and life support; control and protection; communication and instrumentation; and the mission.

2175
Hartgering, J. B.
ENGINEERING AND THE LIFE SCIENCES. — IRE Internat. Convention Record, 10 (9): 91-93. 1962.

The potential contribution of the engineering sciences to the life sciences in basic research, problem-oriented studies involving man-machine complexes, and the development of instrumentation are recognized. The basis for development of any new field, particularly one involving integration of several disciplines, will depend on the education pattern devised. Experimental programs now offered by a few universities, leading to a degree in biomedical engineering, may result in graduates with limited potentials. An educational program is needed which will insure that first-rate life scientists and first-rate engineers have a working familiarity with the problems of and an understanding of each others technologies. (Author's summary)

2176
Hill, P. R.,
and E. Schnitzer
ROTATING MANNED SPACE STATIONS. — Astronautics, 7 (9): 14-18. Sept. 1962.

There are many potential uses of manned space stations, including the following: (1) gravity research, (2) launch-platform experiments, (3) space-systems environmental research, (4) communications, (5) earth observation, and (6) astronomical observation. This list shows that few applications involve a requirement for artificial gravity. Presented is a graph defining the rotational characteristics needed in conjunction with interpretation of physiological responses (comfort zone). Elementary forms (cross, rim, flywheel, cylinder, axial modules, in plane modules) considered for space stations are evaluated and diagrammed.

2177
Hoover, G. W.
THE MAN-MACHINE SYSTEM IN SPACE VEHICLES. —In: Space research and technology, p. 18-24. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

Proposals are made for an integrated approach by all concerned to the problem of finding out under what conditions a man works most happily and efficiently in a closed vehicle. The development of the U. S. Army-Navy Instrumentation Program for providing equipment embodying optimum data presentation and control for the man-machine system is outlined, and the application of the concepts to the spaceship is indicated. In general, man must have an operational environment which will permit him to make maximum use of all of his sensory systems without having to be rehabilitated, without reconditioning of his reflexes, and one which will not require extreme selective measures. This operational environment usually closely resembles that found in his terrestrial home, both physiologically and psychologically. (Author's abstract, modified)

2178
Johnston, R. S.
BIOENGINEERING. — In: Proceedings of the NASA-University conference on the science and technology of space exploration, vol. 1, p. 415-422. Washington, D. C.: National Aeronautics and Space Administration, Dec. 1962.

Bioengineering deals with the application of engineering principles to provide life-support and crew systems to meet the physiological requirements of aerospace flight. Three types of environmental control systems are described to show the evolution of design and the integration of various components as mission durations increase. These control systems are for the Mercury and Apollo spacecraft and for a space station. Another major area in bioengineering is the development of crew systems. This includes pressure suits, restraint and support systems, and the integration of this hardware into the crew stations. A summary is presented of some of the research goals for the next five years.

2179
Kama, W. N.
VOLUMETRIC WORKSPACE STUDY. I. OPTIMUM WORKSPACE CONFIGURATION FOR USING VARIOUS SCREWDRIVERS.—Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718496). Technical Documentary Report no. ARML-TDR-63-68 (I), Aug. 1963. vii+28 p.

Subjects removed and installed a component (transformer) using various screwdrivers under 15 different workspace configurations with the transformer placed in 3 different orientations with respect to the aperture. The different workspace configurations were achieved by combining 5 different aperture sizes (8, 10, 12, 14, and 16 inches) and 3 different depths (6, 12, and 18 inches). Work time decreased as aperture size decreased. However, increasing aperture size above 10 to 12 inches did not appreciably shorten work time. Increasing the depth of the component within the workspace resulted in longer work time. However, work time increased appreciably only at depths in excess of 12 inches. Component orientation with respect to the aperture was an important determinant of performance. Work time increased as orientation changed from a straight-line access (back) to a right-angle access (bottom and side). (From the author's abstract)

2180
Kay, H.
CHANNEL CAPACITY AND SKILLED PERFORMANCE.—In: Defence Psychology: Proceedings of a Symposium held in Paris, 1960 (NATO Conference Series, 1), p. 161-168; discussion, p. 168-169. Ed. by F. A. Geldard. Oxford, etc.: Pergamon Press, 1962.

Experiments on the capacity of the human motor system in assembly-type operations and on the function of short-term memory in perceptual motor skills are discussed as applying to a range of man-machine systems in military technology requiring the ability to execute tasks while processing a flow of incoming signals.

2181
Kidd, J. S.
A NEW LOOK AT SYSTEM RESEARCH AND ANALYSIS.—Human Factors, 4 (4): 209-216. Aug. 1962.

This report is an attempt to integrate some conceptual and methodological divergencies in man-machine system research. A conceptual format and a procedure for input analysis are proposed which are derived from a cybernetics model. The format is suggested as a means to organize theoretical propositions. Some problems related to real-time simulation as a research method for system research are considered and an approach to methods improvement is discussed. (Author's abstract)

2182
McFarland, R. A.
ERGONOMICS—THE STUDY OF MAN AT WORK, WITH SPECIAL REFERENCE TO THE PSYCHOLOGICAL FACTORS IN THE PRACTICE OF INDUSTRIAL HYGIENE.—Amer. Indus. Hyg. Assoc. Jour. 24 (3): 209-221. May-June 1963.

Many major problems in equipment and workspace design have resulted from the failure to give sufficient consideration to human capabilities and limitations. The effectiveness of any man-machine system depends upon the integration of the biological characteristics of the operator with the mechanical design of the equipment and working areas. The initial phase of a program in human engineering, or ergonomics, should always consist of an advance analysis of the equipment including a survey of the nature of the task, the work surroundings, the location of controls and instruments, and the way the operator performs his duties. The basic data needed in human engineering include those which describe the range of human body size at rest and in motion, biomechanical abilities including range, strength, speed and accuracy of motion, sensory abilities, and human reactions to the physical variables of the environment. Only by the application of these kinds of data to the design of the workspace, controls, instruments and environment, can the worker be assured of maximum comfort, efficiency, and safety in the performance of his task. (From the author's summary) (31 references)

2183
McRuer, D. T.,
and I. L. Ashkenas
DESIGN IMPLICATIONS OF THE HUMAN TRANSFER FUNCTIONS. —Institute of the Aerospace Sciences, New York, N. Y. IAS Paper no. 62-188, 1962. [18] p. (Presented at the IAS Man-machine competition meeting, Seattle, Washington, Aug. 10-11, 1962).

The restricted circumstances for which an adequate mathematical model of human dynamic behavior is presently known are discussed. The model itself is described in mathematical terms which are then physically explained. Simple example applications of the model to vehicle design are presented and more sophisticated applications, reported elsewhere, are noted. The model when combined with conventional servoanalysis methods is a powerful design tool which can be used to properly delineate man's role as an active controller. (Authors' abstract)

2184
May, D.
MAN-POWERED FLIGHT.—Flying, 72 (6): 36-37, 94-96. June 1963.

A progress report is given of the three groups competing in the Kremer competition for producing and flying a man-powered aircraft over a measured course and above a height of 10 feet. Two of the three planes each with a single pilot have already flown, while the third plane carrying two men is near completion. Data from the flights of the single-piloted aircraft reveal that horsepower requirements for takeoff is 0.55 horsepower for one minute and 0.45 horsepower for each additional minute of flight. Flight conditions at these low airspeeds (about 20 miles per hour) showed that pilot training of the standard type offered little advantage to the trained pilot. An untrained individual was soon able to fly as easily as the experienced pilot. Various aspects of the aircraft design are given.

2185
Morgan, C. T.,
J. S. Cook, A. Chapanis, and M. W. Lund, editors.
HUMAN ENGINEERING GUIDE TO EQUIPMENT DESIGN.—615 p. New York: McGraw-Hill Book Company, 1963.

This is a comprehensive source of human engineering information together with definite design recommendations. Stressed aspects include man-machine system planning, visual and auditory display of information, design of controls and work places, design for ease of maintenance, environmental effects on performance, and anthropometric data. The material furnished by different contributors is arranged under the following chapter headings: Chapter 1. The man-machine system. Chapter 2. Visual presentation of information. Chapter 3. Auditory presentation of information. Chapter 4. Speech communication. Chapter 5. Man-machine dynamics. Chapter 6. Design of controls. Chapter 7. Layout of workplaces. Chapter 8. Arrangement of groups of men and machines. Chapter 9. Design for ease of maintenance. Chapter 10. Effects of environment on human performance. Chapter 11. Anthropometry. (486 references)

2186
Olling, E. H.
EARTH ORBITING SPACE STATIONS: MISSIONS, OBJECTIVES, APPLICATIONS, AND CAPABILITIES.—Astronautics and Aerospace Eng., 1 (1): 52-55. Feb. 1963.

Currently, the most immediate steps following the successful completion of a manned lunar landing appear to be: (1) placing a manned space station in the Earth's orbit to conduct research and to perform a wide variety of space operations; (2) establishing a manned lunar base to assist in lunar exploration and exploitation; and (3) accomplishing manned planetary flights to explore the near planets, e.g., Mars and Venus. The space-station program as envisioned is based on existing technology, launch vehicles and sites, range and tracking networks, and possibly a modification of the existing Apollo space craft as the logistics vehicle to transport the crew and cargo to and from the space station. Several approaches have been proposed for executing such a space station, and many different ones are now under investigation. Examples appearing to merit the most consideration are listed. The operational schedule of the program as described is limited only by effective program approval, funding, and launch vehicle availability.

2187
Oshanin, D. A.,
and V. F. Venda
[ON THE IMPROVEMENT OF OPERATOR EFFICIENCY IN MAN-MACHINE SYSTEMS] O nekotorykh putiakh povysheniia effektivnosti operatorskogo truda v sistemakh "chelovek i avtomat".—Voprosy psikhologii (Moskva), 8 (3): 23-36. May-June 1962. In Russian, with English summary (p. 36).

In complex automated systems most of the control functions are carried out by computers. The reliability of the operator in man-machine systems is determined by his readiness to act at the appropriate moment, i.e., the ability to undergo a sudden transition from the role of passive observer to that of an active participant in a given process. Since at the end of long periods of watchfulness an operator becomes less attentive, it is suggested to include into training programs suprise interruptions of computer operations at a given phase in order to develop appropriate reflexes. The optimal conditions of man-machine systems can be determined only by experimentation with the aid of mathematical models which include all known factors. The authors present a number of diagrams of suggested man-machine systems.

2188
Ozkaptan, H.,
and R. Gettig
COMPUTER SIMULATION OF MAN-INTEGRATED SYSTEMS.—Behavioral Sci., 8 (3): 259-266. July 1963.

The complexity of mission requirements in high altitude and space flights and the necessary complexity and dependability of the equipment call for commensurate advances in the utilization of data about human resources. A model for computer simulation is proposed which delineates the optimum design utilization of man-machine resources relative to desired systems criteria. This includes the allocation of human and equipment resources to system requirements and the simulation of the system throughout the mission for purposes of evaluation. Many missions can be simulated and evaluated which utilize different combinations of resources under different environmental conditions.

2189
Parin, V. V.,
and R. M. Baevskii
[PROBLEMS IN CYBERNETICS AND SPACE MEDICINE] Voprosy kibernetiki i kosmicheskaia meditsina.—Izvestiia Akademii nauk SSSR, Seriia biologicheskaia (Moskva), 1963 (1): 9-14. Jan.-Feb. 1963. In Russian, with English summary (p. 14).
Translation in: Soviet studies in space biology and medicine, p. 8-14. U. S. Dept. Commerce, Joint Publication Research Service no. 18,538. April 4, 1963. (OTS no. 63-21498).

The role of cybernetics in space medicine is discussed. In the authors' opinion it will play a decisive role in furthering research in a number of related fields; the information theory is already widely used in telemetry, coding, and data processing as well as in the mathematical treatment of experimental material. Closed ecological systems are being developed with the aid of automatic control methods. The problems of biological prognosis are intimately connected with mathematical models and computer techniques. The vestibular disturbances experienced by Titov on his orbital flight are regarded as an illustration of the above mentioned connection. The design of biological indicator systems for space flights will also benefit by the use of mathematical methods. In conclusion, the necessity for further development and research in the fields of biological regulation, theory of information, and computer design is emphasized.

2190
Pearson, W. H.
EFFECTS OF VARIATION OF THE DRIFT PARAMETER ON CONTROL OF A STOCHASTIC PROCESS.—Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7183, Task no. 718304). Technical Documentary Report no. MRL-TDR-62-72, Aug. 1962. iii+16 p.

Man's ability to control a simple process whose systematic drift is obscured by random variations was examined. Of the many combinations of systematic drift and random variation possible in such a process, four were investigated experimentally. Under two of these conditions the process would, if uncorrected, tend to diverge from the control limits. Under the other two conditions the process would tend to remain within or return to the control limits. For the two "explosive" conditions an appropriate control strategy would be to correct the process before it exceeded the control limits. For the two "self-controlled" conditions an appropriate strategy would be to correct infrequently. Subjects corrected before control limits were exceeded more frequently under the "explosive" conditions than under the "self-controlled" conditions. However, under the "self-controlled" conditions the subjects corrected more frequently than necessary. This suggests that when operating a "self-controlled" process humans do not behave optimally. (Author's abstract)

2191
Pogrund, R. S.
PHYSIOLOGICAL ASPECTS OF THE SPACEMAN. — In: Space logistics engineering, p. 55-135. Ed. by Kenneth Brown and L. D. Ely. New York: John Wiley and Sons, 1962.

The complexity of space logistics engineering for the comfort of the astronaut in a space vehicle is described as a function of mission duration, and of the operational requirements and performance capabilities expected. The following physiological parameters are reviewed: (1) vehicle-induced stresses (propulsion, noise, vibration, accelerations, zero gravity, re-entry, emergency escape); (2) internal environment of the space capsule (sources of oxygen supply, handling food, biological photosynthesis systems, methods of carbon dioxide elimination, water and waste control, toxicological considerations, temperature and humidity regulation); (3) radiation hazard (shielding requirements, low-level chronic exposure hazard); and (4) psychological stress (isolation, confinement, and sensory deprivation). Included are 27 representative tables. (149 references)

2192
Pugh, L. G. C. E.
HUMAN FACTORS IN A SPACE CABIN, WITH SPECIAL REFERENCE TO WEIGHT AND ECONOMY. —In: Space research and technology, p. 31-33. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

Human problems in space travel are considered in the light of experience of extreme conditions of hypoxia and climatic stress of Mount Everest. These methods of saving mass are discussed: (1) by reduction of the air pressure in a space capsule; (2) by choice of lightweight personnel; and (3) by economy of food and fluid. A table shows the minimum weight requirements per day for food, fluid, oxygen, and carbon dioxide absorbent for persons weighing 75 and 45 kg., with unrestricted fluid and with restricted food and fluid intake. (Author's abstract, modified).

2193
Reed, L. E.,
J. P. Foley, R. S. Graham, and J. B. Hilgeman
A METHODOLOGICAL APPROACH TO THE ANALYSIS AND AUTOMATIC HANDLING OF TASK INFORMATION FOR SYSTEMS IN THE CONCEPTUAL PHASE.—Ford Motor Co., Newport Beach, Calif. (Contract AF 33 (657)8639); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 1710, Task no. 171006). Technical Documentary Report no. AMRL-TDR-63-78, Aug. 1963. v+120 p.

This report presents a technique for analyzing and processing task and task requirements data generated during the conceptual phase of system development. The technique includes: (a) a category system for organizing, classifying, and coding task information; (b) a task analysis format for recording and coding task descriptions and task rqeuirements; and (c) computer update and retrieval programs. Task requirement data appearing in documents resulting from the Air Force Study Requirement program are analyzed and used for testing the technique on an actual personnel training problem. The test program indicates that the technique can be used to assist human factors specialists to isolate and process task and task requirements associated with advanced systems for making personnel, training, and training equipment recommendations. (From the authors' abstract)

2194
Siegel, A. I.,
and J. J. Wolf
COMPUTER SIMULATION OF MAN-MACHINE SYSTEMS.—In: Unusual environments and human behavior, p. 61-86. Ed. by N. M. Burns and others. London: Collier-Macmillan Ltd., 1963.

A mathematical model of man-machine interactions is described that can provide human performance information on optimization. The digital simulation technique described involves four tasks: carrier landing, in-flight missile launching, in-flight refueling, and in-flight intercept. For all four tasks reasonable concordance was found between the predictions from the model and outside criteria of success on the tasks involved.

2195
SPACE LOGISTICS ENGINEERING. — Ed. by Kenneth Brown and L. D. Ely. xii+623 p. New York: John Wiley and Sons, 1962.

This book discusses the way logistic considerations affect the design of components and subsystems of space vehicles. The technical disciplines presented include: astrodynamics, guidance and control systems, propulsion, vehicle design, communications, supply support, maintenance requirements, transportation, personnel requirements, earth-lunar logistics employing orbital assembly and launch, facilities for space logistics, reliability and developmental testing, civilian and military uses of space, and economics of space travel. These subjects are oriented towards the logistics requirements that exist in the space environment when orbiting the Earth, traveling to and from the Moon, or exploring the planets Mars and Venus. Included is a subject index. Pertinent chapters are abstracted separately, see items no. 1, 169, 2133, 2191, 2218, 2224.

2196
Still, E. W.
HIGH ALTITUDE CHAMBERS AND PRESSURE SUITS AND THEIR PART IN MANNED FLIGHT TO THE MOON.—In: Space research and technology, p. 72-110. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

An attempt is made to reduce to basic facts the environmental system engineering to sustain man during all phases of a journey to the Moon and back. It reviews and gives diagrams for current and projected man-bearing vehicles. Information from these projects is then used to estimate cabin size, crew number, flight duration, and possible heat loads. A description is given of the environmental requirements necessary to sustain life and assumptions of flight phases. A detailed description is given of the environmental engineering systems for a small Earth-to-orbit vehicle, a large space station, and a lunar suit. Possible emergencies and their countermeasures are mentioned. The conclusion is reached that the environmental engineering for a manned trip to the Moon presents no insuperable extension of existing knowledge, but if voyages to Mars or other planets are projected, a considerable development of closed-circuit ecology will be required. (Author's abstract, modified)

2197
Wade, E. A.,
and E. Cohen
POPULATION STEREOTYPES IN THE DIRECTION OF MOTION OF THUMBWHEEL SWITCHES.—Human Factors, 4 (6): 397-399. Dec. 1962.

No population stereotype relating direction of movement of a thumbwheel switch and the increase or decrease of the number it displays was found in a test with ninety subjects, half of whom were instructed to change the setting from 2 to 4 (increase setting), the other half from 4 to 2 (decrease setting). In the interest of uniformity, upward-to-increase is recommended as the preferred human engineering practice. A recommendation is also made to decrease required torque and to increase the accessibility of the gripping surface. (Authors' abstract)

2198
Zinchenko, V. P.,
and D. Iu. Panov
[CRUCIAL PROBLEMS IN ENGINEERING PSYCHOLOGY] Uzlovye problemy inzhenernoi psikhologii.—Voprosy psikhologii (Moskva), 8 (5): 15-20. Sept.-Oct. 1962. In Russian, with English summary (p. 30).

The problems of complex automation are intimately connected with the functional ability of human operators. As the operator is denied an opportunity to directly observe the control aggregates, the problem of information coding becomes of paramount importance. In view of perceptual limitations in man it is necessary to create engineering systems with a maximal inclusion of the functional characteristics and capabilities of the human operator. By the careful analysis and integration of already accumulated data a unified theory of engineering psychology could be formulated. Such a step will lead to the elimination of pure empiricism now prevailing in this field.

b. Operational Aspects

2199
Adams, J. A.,
and L. R. Creamer
DATA PROCESSING CAPABILITIES OF THE HUMAN OPERATOR. — Jour. Engineering Psychol., 1 (4): 150-158. Oct. 1962.

An experiment was conducted on human data processing capabilities, and a test was made of the hypothesis that the human operator has a one-channel decision center whose function is resolving event uncertainties. The Bisensory Discrete Matching Task was used, where discrete audio and visual stimuli were jointly presented for concurrent responses by the two hands. The visual stimulus series in the bisensory task always had event uncertainty to occupy the one-channel central decision mechanism in accordance with the hypothesis, and concurrent audio stimuli were either partly or completely redundant. Comparison of performance under these two bisensory conditions was with a unisensory control condition that only practiced the visual stimulus series. There were 15 subjects in each of the three conditions. The results showed impairment for both bisensory conditions, and it was concluded that the human operator can be considered a one-channel system providing this channel is taken to be concerned with the resolution of event uncertainty. Automatization of responses to completely redundant stimuli was questioned. (Authors' summary)

2200
Baker, C. A.,
and W. C. Steedman
ESTIMATION OF VISUALLY PERCEIVED CLOSURE RATES.—Human Factors, 4 (6): 343-347. Dec. 1962.

The ability of subjects to estimate the relative distance traveled by a luminous object approaching on a collision course and viewed in an otherwise stimulus-free field was investigated. This research stems from an analysis of visual skills anticipated for certain manned space vehicle operations. The stimulus object at onset had an angular subtense of 4, 12, or 36' of arc. It approached at two velocities from five starting distances, thus yielding a total of 30 experimental conditions. The subjects' task was to indicate when the stimulus object had traversed one-half of the original distance. Large constant and variable errors were evident in the estimates of subjects with no training at the task. Subjects provided with training, through knowledge of results after each estimate, demonstrated a considerable reduction in both constant and variable errors. After training, subjects were able to estimate when the object had reached the half-way point with an accuracy such that 50 per cent of the half-way estimates fell within a range equal to 5% of the initial observation distance. (Authors' abstract)

2201
Baker, R. A.,
J. R. Ware, and R. R. Sipowicz
SIGNAL DETECTION BY MULTIPLE MONITORS. — Psychol. Record, 12 (2): 133-137. April 1962.

Twenty-eight armor trainees in individually isolated rooms monitored brief interruptions of a continuous light source for a three-hour period. Individual detection probabilities for each subject were analyzed in an attempt to determine the minimum number of subjects necessary to insure the detection of every one of the 72 signals presented. The results indicated a minimum number of six would be required. This finding, however, was shown to depend wholly upon the monitoring ability of the subjects used. For subjects of high individual detection probabilities, a minimum number of three are required to insure detection of every signal. If, however, poor monitors are used the minimum number increases to 14. (Authors' summary)

2202
Besco, R. O.,
D. K. Bauerschmidt, and C. S. McElwain
STUDIES OF MANUAL ATTITUDE CONTROL: THE EFFECT OF SPACE VEHICLE CONFIGURATION. — IRE Trans. on Human Factors in Electronics, HFE-3 (2): 57-61. Sept. 1962.

A study was conducted to determine the effects of the distribution of the moments-of-inertia of space vehicles on the ability of crew members to stabilize the attitude of tumbling space vehicles. Five pilot-engineers performed a stabilization task on a fixed-base manned space vehicle simulator which was mechanized to provide three degrees of angular freedom. Five space-vehicle configurations were investigated under two conditions of displayed information content. Results indicated that certain vehicle shapes or configurations are more difficult to control and are more dependent on the amount of displayed information for efficient control. Implications of the findings are presented for future design of manually controlled space vehicles. (Authors' summary)

2203
Carterette, E. C.,
and M. Cole
REPETITION AND CONFIRMATION OF MESSAGES RECEIVED BY EAR AND BY EYE.—Quart. Jour.

Exper. Psychol. (Cambridge), 15 (3): 155-172. Aug. 1963.

A rating method was used to obtain operating characteristics for 60 heterogeneous words. A single message was heard in noise, or seen briefly in a tachistoscope. It was repeated until it had been assigned to the highest accuracy category ("confirmed") or sent a maximum of six trials. The comparisons showed that it matters little whether reception is by eye or by ear. Whether within a trial or over successive repetitions, accuracy of reception is a direct function of the confidence rating and is relatively independent of the intelligibility level. Neither do the accuracy of reception or the distributions of rating categories change markedly over trials. Although no direct test was made, it appears that accuracy of reception is not lessened by the task of rating. Both visual and auditory data are fitted reasonably well by predictions made from a simple stochastic model based on the assumptions that (1) intelligibility, (2) probability of a correct acceptance, and (3) probability of an incorrect acceptance remain constant over successive repetitions. The model fits the visual better than the auditory data, as might be expected, since conditions of reception are more homogeneous over trials for vision than for audition. (Authors' summary) (25 references)

2204
Clark, H. F.
VIEWS ON NOISE ABATEMENT.—Airline Pilot, 32 (5): 12-13, 20. June-July 1963.

The pilot's responsibility for the safety of the passengers, crew members, cargo, and airplane precludes his acceptance of proposed procedures, such as certain abatement techniques, which are not consistent with good operating practices. Several noise abatement procedures are outlined which the Air Line Pilots Association shall refuse to endorse or accept. Reasons why these procedures would decrease flight safety are discussed.

2205
Cockett, T. K.,
and C. C. Beehler
PROTECTIVE EFFECTS OF HYPOTHERMIA IN EXPLORATION OF SPACE. — Jour. Amer. Med. Assoc., 182 (10): 977-979. Dec. 8, 1962.

Manned space probes present numerous difficult and as yet unsolved biomedical problems. In line with the development of biomedical systems for protecting man in space exploration a review is presented of the protective effect of general hypothermia. Hypothermia reduces the rate of cellular metabolism, and provides protection from shock in dysbarism, bacteremia, trauma, radiation exposure, and excessive g forces. A state of artificial hibernation is preferable to deeper degrees of cooling, because general body hypothermia is a stressful condition. By further elucidation of the chemistry and physiology of hibernation, drugs may be synthesized for inducing a state resembling hibernation in man. This nonstressful modality may be used by one member at a time in a rotating fashion in a space vehicle with a multiple crew.

2206
Conklin, J. E.
VISUAL REQUIREMENTS FOR LANDING ON THE MOON.—Human Factors, 4 (6): 335-342. Dec. 1962.

An analysis was conducted to determine some of the visual requirements for landing a shuttle spacecraft on the surface of the moon and subsequently achieving rendezvous with the command module in orbit. The major questions investigated were: (1) Is the astronaut capable of perceiving moon landmarks while in orbit in order to detect and identify a desired landing area? and (2) Can the astronaut perceive the command module from the moon during all phases of its orbit from lunar horizon to entering the moon's shadows? To evaluate these questions, the properties of the moon landmarks were examined in terms of size (visual angle subtended), contrast, and velocity of the moving imagery. In addition, stellar magnitude and luminance data were calculated for the command module and the earth as seen from the moon for different phase angles and albedos. It is suggested that the astronaut should have little difficulty in locating and identifying lunar landmarks for initiating a deorbit and landing sequence on the moon with unaided eyes. Difficulties of orientation, however, may be encountered at very low altitudes during the final stages since the steepness of slope of crater rims may not be great enough to be perceived as a ridge, and thus as an identifying landmark. The effects of glare on the discrimination of the command module are discussed. (Author's abstract, in part) (26 references)

2207
Cook, K. G.,
R. M. Beazley, and J. E. Robinson
AIRCRAFT CONSPICUITY AND FLIGHT ATTITUDE INFORMATION PROVIDED BY EXTERIOR PAINT PATTERNS. — Jour. Applied Psychol., 46 (3): 175-182. June 1962.

Experiments were conducted to determine the relative conspicuity of aircraft exterior paint patterns, and to investigate whether such paint patterns aided pilots in determining the attitude of the aircraft. The conspicuity studies, using paired comparisons of model airplanes, gave evidence that: (a) amount of red-orange fluorescent paint coverage is positively correlated with conspicuity; (b) high-brightness paints should be placed on the upper surfaces of the aircraft and low-brightness paints on the lower portions; (c) maximizing brightness contrasts between different parts of the aircraft surfaces does not enhance conspicuity; and (d) flight attitudes, background, lighting conditions, and differences in subjects did not affect conspicuity significantly. The attitude studies in which pilots matched the model airplanes in some 1 of 15 attitudes, with 1 of 15 models mounted on a small display, indicated that the paint patterns used did not aid the pilots in making judgments of aircraft attitude. Differences in backgrounds and lighting conditions did not greatly affect subjects' ability to determine attitude. (Authors' abstract)

2208
Jones, M. R.
COLOR CODING.—Human Factors, 4 (6): 355-365. Dec. 1962.

Research published in the last decade on color as a coding device is discussed. The method of absolute judgment yielded similar findings with respect to identifications of surface and luminous hues. These findings suggest that a reliable undimensional hue code should not contain more than about eight optimally spaced stimuli. Variations in purity and luminance in addition to wavelength can significantly increase the number of usable code categories. However, criteria for code selection in a given situation should depend not only upon the number of visual objects to be differentially identified but also upon the type of task for which the code functions. In particular, color codes do not appear to be suited for situations that demand rapid and precise identification, whereas they are valuable in decreasing search-time with locate-type tasks. (Author's abstract) (51 references)

2209
Kasten, D. F.
HUMAN PERFORMANCE IN A SIMULATED SHORT ORBITAL TRANSFER.—Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-62-138, Dec. 1962. v+39 p.

Human performance was measured in a simulated short-range, coplanar-orbital rendezvous task. Orbital conditions and vehicle dynamics were programed on an analog computer. Two systems of vehicle control and one system of information display were investigated. Performance criteria included impact velocity, fuel consumption, and transfer time required. Comparisons were made between control systems and between initial conditions. Subject performance was better with an orthogonal-axes thrust-control system than with a pitch attitude and one-axis thrust-control system. The simulated direct-vision target display was found to be marginally acceptable. Suggestions about control systems and rendezvous techniques are included. (Author's abstract)

2210
Kidd, J. S.,
and R. G. Kinkade
OPERATOR CHANGE-OVER EFFECTS IN A COMPLEX TASK. —— Jour. Engineering Psychol., 1 (2): 82-91. April 1962.

Two related experiments are described. The first one attempted to detect and describe changes in the performance of a simulated air traffic control system as a consequence of operator change-over and extended operational activity (3.5-hour work shift). The second experiment evaluated various change-over procedures in order to determine effective techniques for the moderation of the change-over decrement in performance. Twelve laboratory-trained controllers participated. The first phase revealed a marked but short-duration change-over loss in performance. During the 3.5-hour period following change-over, the performance output was remarkably stable. A brief but significant end-spurt was noted at the conclusion of the work period. The failure to observe a fatigue decrement was attributed to the complexity of the task. The second phase revealed that the extent of pre-change-over participation by the replacement operator is an effective factor in controlling performance loss. The mechanisms of warm-up and preparatory set were considered in the light of these findings. (Authors' summary, modified)

2211
Leech, F. J.,
and V. E. Sackschewsky
BOUNDARY LAYER NOISE MEASUREMENTS OF THE F-102A AIRCRAFT.—Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 723104). Technical Documentary Report no. MRL-TDR-62-71, Aug. 1962. iii+19 p.

Inflight noise measurements were made on an F-102A aircraft at speeds up to Mach 0.90 at 5000 feet and up to Mach 1.16 at 25,000 feet. Boundary layer pressure fluctuations were measured at seven positions on the aircraft using specially designed condenser microphones. Internal measurements were made at five positions using conventional condenser microphones. The measured sound pressure levels are discussed as functions of indicated air speed, octave bands, Mach number, and altitude. The results show a wide variation in the dependence of sound pressure level on indicated air speed, the dependence varying between the 0.55th and the 4.9th power of the indicated air speed. A sharp drop in sound pressure level was observed at several positions as the aircraft passed through Mach 0.83. A spectrum shape change was observed as the aircraft reached and passed through the vicinity of Mach 0.83, the peak of the spectrum being shifted to higher frequencies. There are also indications that the apparent noise reduction through the aircraft skin derived from these data is not constant but depends on both the indicated air speed and altitude. (Authors' abstract)

2212
Majendie, A. M. A.
AUTOMATIC LANDING: THE ROLE OF THE HUMAN PILOT. —— Institute of the Aerospace Sciences, New York, N. Y. IAS Paper no. 62-183, 1962. [46] p. (Presented at the IAS Man-machine competition meeting, Seattle, Washington, Aug. 10-11, 1962).

A fundamental analysis is presented of the philosophical relationship between men and machines in the context of applying either or both to an operational task – automatic landing systems in commercial aircraft. Consideration is devoted to (1) human operators and automatic machines applied to operational tasks, (2) control and monitoring functions, (3) safety as it relates to the pilot and automatic landing systems, and (4) the role of the pilot in practice. It is concluded that there is no real conflict between man and machines, that the automatic system will not affect the crew complement, or the basic responsibilities of an airline pilot, and that the potential of automatic systems can only be realized by a proper understanding of their true implications. (Author's abstract, in part)

2213
March, A. H.,
and A. L. McPike
NOISE LEVELS OF TURBOJET- AND TURBOFAN-POWERED AIRCRAFT.—Sound, 2 (5): 8-13. Sept.-Oct. 1963.

Results of ground runup, flyover, and interior noise-level surveys of DC-8's equipped with suppressed JT3C-6 turbojet and unsuppressed JT3D-1 turbofan engines are given. At take-off power during ground runup, the turbofan engine, producing 3500 pounds more thrust than the turbojet engine, generated a total acoustic-power level that was about 2 decibels lower. Flyover noise measurements showed that the over-all sound-pressure levels were about 5 decibels lower with the turbofan installation; the perceived noise levels were about 5 PNdB lower. These differences were due to the change in exhaust-nozzle configuration and jet-exhaust velocity. Cabin-noise levels at cruise conditions were about the same in both types of airplanes, due to the dominance of boundary-layer noise. (Authors' abstract)

2214
Miller, J. W.,
W. Bevan, John L. Brown, J. W. Senders, Olin W. Smith, and R. Trumbull
VISUAL PROBLEMS OF SPACE TRAVEL: REPORT OF WORKING GROUP V ARMED FORCES-NRC COMMITTEE ON VISION.—vii+55 p. Washington, D. C.: National Academy of Sciences-National Research Council, 1962.

Research data and speculations on the problems related to vision in space travel are organized under seven chapter headings: Space flight missions; Visual environments of space; Visual effects of gravitational stress; Visual effects of weightlessness and simulated gravity; Visual problems within the space vehicle; Additional problems related to space flight; and Utilizing man's vision in space. The report updates a previous report by John L. Brown on "Sensory and perceptual problems related to space flight". (192 references)

2215
Morse, B. E.
INFLUENCE OF NOISE CONTROL COMPONENTS AND STRUCTURES ON TURBOJET ENGINE TESTING AND AIRCRAFT GROUND OPERATION.—Kittell-Lacy, Inc., El Monte, Calif. (Contract AF 33(616)-5789); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7231, Task no. 723104). Technical Documentary Report no. AMRL-TDR-62-134, Dec. 1962. vii+98 p.

Aerodynamic and thermodynamic design criteria for turbojet engine test cells and ground runup suppressors are summarized. These criteria are discussed and their uses are illustrated by examples of typical design solutions. The presence of noise suppression structures can have significant influences upon the operation of the turbojet engine. These influences are enumerated and evaluated with recommendations for establishing maximum acceptable effects. Typical test cell configurations are presented and design criteria are established for providing noise suppression facilities which may be used for testing a full-size aircraft or an engine by itself. These facilities can be either permanent structures or portable units. (Authors' abstract)

2216
Nicholson, R. M.
MAXIMUM INFORMATION-HANDLING RATES FOR SEQUENTIALLY PRESENTED VISUAL STIMULI.—Human Factors, 4 (6): 367-373. Dec. 1962.

The purposes of this study were to: (1) determine information-handling rates for sequentially presented stimuli; (2) demonstrate the relationship between information-handling rate and size of the surface that the operator must monitor; and (3) determine the effect of variations in duration of stimulus exposure. Performance measures were obtained for thirty subjects on three different panel sizes at two different exposures. Two methods were used in obtaining data: a method of sequentially varied stimuli and a method of randomly varied stimuli. All performance curves indicate a monotonic decrease as the speed of presentation was increased. Speed of presentation and the interaction of speed of presentation and panel size were determined to be significant at the 0.005 and 0.05 levels, respectively. The effect of the exposure times variable was nonsignificant. The method of randomly presented stimuli resulted in significantly better performance than the method of sequentially varied stimuli. (Author's abstract)

2217
Pennington, J. E.,
and R. F. Brissenden
VISUAL CAPABILITY IN RENDEZVOUS.—Astronautics and Aerospace Eng., 1 (1): 96-99. Feb. 1963.

Previous studies of visual perception are reviewed as they relate to man's visual rendezvous capability. The various phases of a visual rendezvous operation, as now conceived, are described including acquisition, establishment of intercept, range and range-rate estimation, braking operations, and docking. Visual tasks (detection, angular-rate discrimination, distance and closure-rate judgment, attitude) and target parameters (intensity, color-signal sequence, motion cues, aspect) are also described. Visual rendezvous simulation studies at the National Aeronautics and Space Administration's Langley Research Center showed that man can perform rendezvous efficiently. However, the optimum use of both man and machine will be necessary for maximum efficiency and reliability.

2218
Pickrel, E. W.
PERSONNEL REQUIREMENTS. — In: Space logistics engineering, p. 136-161. Ed. by Kenneth Brown and L. D. Ely. New York: John Wiley and Sons, 1962.

Logistic justifications for putting man in space on a systems basis include his contributions to system reliability as controller and activator through time, decision functions and space vehicle control, evaluation of cues as they relate to the total system mission, and choice of the appropriate path to follow. Classes of man's functions include sensing, coding, encoding, and activating. He contributes to the operational aspects of mission success in navigating to avoid the orbits of comets and known meteor streams, acts as pilot during return to the Earth's atmosphere, and accomplishes maintenance tasks. The presence of man in the space vehicle changes the rigid, mechanical, non-adaptive system into a flexible, adaptable vehicle that can defer decisions until more and relevant data are forthcoming. Discussion is included on the situational demands (emotional, sensory, skill) placed on the astronaut and of the selection and training procedures for astronauts. A study model is presented of a man-machine situation.

2219
Williams, C. H.
THE EFFECT OF JET NOISE ON RESIDENTIAL AREAS. —— Residential Appraiser, 28 (4): 16-18, 24. Aug. 1962.

People living near flight paths express concern over jet aircraft noise. The problem is a psychoacoustical one, where fear that the plane will fall, and other elements cause people to complain about the noise. In order to cope with the problem of jet noise, the possibilities are discussed of developing quieter aircraft engines, handling variance in individual reactions to noise, altering the air traffic patterns around built-up areas, and moving people from the noise sources. The question of measuring the effect of jet noise on a piece of property is still unanswered.

c. Instruments and Controls (Including Visual Displays)

2220
Aitken, R. C. B.,
H. M. Ferres, and J. L. Gedye
A SUBJECTIVE ASSESSMENT OF FLASHING LIGHTS. —— RAF Inst. of Aviation Medicine (Gt. Brit.), Farnborough; issued by Flying Personnel Research Committee (Gt. Brit.). FPRC no. 1194, April 1962. i+10 p.

This preliminary laboratory experiment was carried out to determine which of five frequencies of an occulting white light within the range of 1.00 to 2.33 c.p.s. would be the most acceptable while flying. It was found that subjective preference scores provided the most useful information to answer this question, and that the most acceptable frequencies were the two lowest ones, namely 1.00 and 1.33 c.p.s. It was concluded that if this result is to be confirmed in a simulated flight situation, these frequencies may also satisfy the requirements of conspicuity. It was also shown that change in skin conductance was related to flash frequency, but that there was no significant alteration in estimates of relative duration of presentation. An investigation of the frequency distribution of "anti-collision" lights at present on 84 civil aircraft revealed that there was a peak frequency of 1.3-1.4 c.p.s. for red lights. (From the authors' summary)

2221
Baevskii, R. M.,
and L. A. Kazar'ian.
[REGISTRATION OF SEISMOCARDIOGRAMS IN DOGS] Registratsiia seismokardiogramm u sobak.— Problemy kosmicheskoi biologii (Moskva), 1: 418-421. 1962. In Russian, with English summary (p. 421).

A method of seismocardiography, which is a modification of ballistocardiography, was employed to study the contractile function of the myocardium of dogs during space flights. A diagram of the electromagnetic sensor employed (60 x 50 x 20 mm.) is included. The sensor is attached to the animal's back. Each cardiac contraction is followed by a cycle of damping oscillations of the "seismic mass" (the magnet and the induction coils) attached to the base of the sensor. The seismocardiogram obtained by this method permits the estimation of the magnitude and configuration of the cardiac contractions.

2222
Baker, D. F.,
and others
SURVEY OF REMOTE HANDLING IN SPACE. —— Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718406). Technical Documentary Report no. AMRL-TDR-62-100, Sept. 1962. iii+42 p.

A survey of industrial opinion on remote handling in space was undertaken to document early concepts and to identify areas of agreement, areas of conflict, and unique ideas relating to the subject. Seven industrial concerns and one military agency provided papers on the role of remote handling in space. These papers are discussed in terms of: (a) remote operations of which there are five major categories – maintenance, assembly, experimentation, transfer operations, and emergency operations; (b) space vehicle design – the manned lightweight capsule, with anthropomorphic gloves, stabilization arms, window ports, and two to three manipulator arms, being representative; (c) manipulator design – concerning actuation, configuration, control, and feedback systems; and (d) space environment factors – vision, weightlessness, temperature fluctuations, high-energy radiation, and micrometeorite collisions. (Authors' abstract)

2223
Bauerschmidt, D. K.,
and R. O. Besco
HUMAN ENGINEERING CRITERIA FOR MANNED SPACE FLIGHT: MINIMUM MANUAL SYSTEMS. —— Hughes Aircraft Co., Culver City, Calif. (Contract AF 33(616)-8168); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-62-87, Aug. 1962. viii+227 p.

Analytical and experimental investigations were made of simple or minimum manual guidance and control systems. A complete three-degree of freedom static simulator was used to study the manual attitude control of space vehicles. Major controller, display, and vehicle configuration parameters were compared experimentally. The system kinematics, manual control and visual factors of space rendezvous and docking maneuvers were analyzed. Procedures for manual participation in space navigation and guidance were studied and a preliminary design of a simple computational aid was developed. The conclusions of all the studies are presented and recommendations are made for the design of manual guidance and control systems. (Authors' abstract) (42 references)

2224
Blasingame, B. P.,
and R. R. Christensen
SPACE GUIDANCE AND CONTROL. — In: Space logistics engineering, p. 162-198. Ed. by Kenneth Brown and L. D. Ely. New York: John Wiley and Sons, 1962.

A discussion is presented of the motion of a body in a gravitational field and of the problem of guidance and control of an intercontinental ballistic missile. These ideas are extended to a manned lunar mission, which involves a landing on the moon and a subsequent return to earth. Consideration is given to manned and automatic guidance and control functions.

2225
Breuhaus, W. O.,
and W. F. Milliken
CONTROL RESPONSE REQUIREMENTS. — Institute of the Aerospace Sciences, New York, N. Y. IAS Paper no. 62-191, 1962. 19 p. (Presented at the IAS Man-machine competition meeting, Seattle, Washington, Aug. 10-11, 1962).

A general discussion is presented of basic problems of pilot-controlled flight as they relate to airplane response characteristics including those in open-loop and closed-loop operations. Suggestions offered to simplify the pilot's tasks (thereby obtaining satisfactory control characteristics) include combining satisfactory flight-path information with satisfactory flying qualities and decoupling fundamental responses of the airplane.

2226
Crannell, C. W.,
and D. A. Topmiller
EFFECT OF GROUPING ON THE TIME REQUIRED TO LOCATE AND RESPOND TO THE ELEMENTS OF A LARGE CONTROL PANEL.—Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718406). Technical Documentary Report no. AMRL-TDR-63-34, May 1963. iii+12 p.

The effects on response and location times of alternative groupings of the elements of a large matrix that simulated a control panel were studied. Four arrangements of 576 elements were evaluated: ungrouped and grouped by 3's, by 6's, and by 12's. The results indicate that grouping by 3's or 6's is superior to no grouping, especially for the interior elements as contrasted to the peripheral elements of the matrix, and that all three of these arrangements are superior to grouping by 12's. The results of this experiment are consistent with those of previous similar studies. (Authors' abstract)

2227
Crawford, A.
THE PERCEPTION OF LIGHT SIGNALS: THE EFFECT OF THE NUMBER OF IRRELEVANT LIGHTS. — Ergonomics (London), 5 (3): 417-428. July 1962.

The experiment described was carried out to find the effect of the number of irrelevant lights on the human response time to light signals appearing among them. Both the signal lights and the irrelevant lights could be made steady or flashing; this produced four conditions of coding of the signal lights from the background, e.g., flashing signal with steady background, and so on. It was found that the geometric mean response time increased to an unusually large extent, from 0.8 second with no background lights up to nearly 2 seconds with 21. A background of flashing lights was found to increase the response time more than a background of steady lights, whether the signal was flashing or not. The shortest response times were obtained when flashing signals were seen against a steady background, and the longest with flashing signals against a flashing background. Thus it is concluded that flashing signals should not be used in conditions where a number of them may appear together within the field of view. (Author's summary)

2228
Crocker, J.,
and J. Lyman
FEASIBILITY STUDY OF A SMALL THERMAL CHAMBER FOR PROGRAMMED TRANSIENT INCREASES AND DECREASES IN TEMPERATURE.— Univ. of California, Los Angeles (Contract AF 33 (616)-6763); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722204). Technical Documentary Report no. AMRL-TDR-63-15, March 1963. iv+36 p.

After a brief review of experimental requirements and practical constraints, performance specifications of a rate of change of 200° F. per minute and a maximum temperature of 600° F. were arbitrarily set for a possible thermal chamber facility. Various methods of heating were examined and the decision was made to make a special study of a fluid wall thermal chamber as a promising approach to achieve the desired specifications. It was found that it should be possible to construct a circulating fluid wall chamber, using commercially available silicone derivative fluids for under $40 per square foot of area, plus a fixed cost for controlling equipment. Based on approximate figures, it was concluded that an 8-foot chamber meeting the desired specifications and with a capability for extending its operation into a thermal range below room temperature, could be constructed for under $50,000. (Authors' abstract) (25 references)

2229
David, H. M.
DEVICE WILL KEEP WATCH ON ASTRONAUT'S TELLTALE EYES. — Missiles and Rockets, 10 (7): 27. Feb. 12, 1962.

A new opthalmoscope for recording retinal reactions is to be delivered to the National Aeronautics and Space Administration by the Pacific Optical Corp. for use in a centrifuge cabin and ultimately for incorporation into Project Mercury. Retinal details as small as 10 micra will be recorded on color film and then televised back to Earth. These reactions, including arterial changes, swelling of the optic nerves, and cellular changes, will enable monitors to check the over-all physiological condition of the astronaut.

2230
Gazenko, O. G.,
and R. M. Baevskii
PHYSIOLOGICAL METHODS IN SPACE MEDICINE.—Artificial Earth Satellites (Consultants Bureau, New York), 11: 72-81. Sept. 1962

English translation of: Fiziologicheskie metody v kosmicheskoi meditsine.—Iskusstvenye sputniki zemli (Moskva), 11: 68-77. 1961. In Russian.

Biotelemetrical methods in space medicine may be grouped along the following lines of application: (1) continuous monitoring of physiological functions in man or animals during space flight, (2) research on the effects of cosmic flight factors on the living organism, and (3) indicators of hazards to human life or health. Along with their use there arise new problems related to the design of transducers and amplifiers, conversion or coding of medical information in a form suitable for input into the telemetry channels, programming of measurements, and the volume of information to be transmitted. A brief review is presented of experience with methods employed on the second and third Soviet space flights, i.e., electrocardiography, seismocardiography (modified ballistocardiography), phonocardiography, arterial oscillography, sphygmography, pneumography, electromyography, actography, thermometry, and investigation of conditioned reflexes.

2231
Geblewiczowa, M.
INFLUENCE OF THE NUMBER OF WARNING SIGNALS AND OF THE INTERVALS BETWEEN THEM ON SIMPLE REACTION TIME.—Acta Psychologica (Amsterdam), 21: 40-48. Feb. 1963.

The relationship between reaction time and the variables connected with warning signals was investigated experimentally. The first problem investigated explored the relationship between the reaction time and the number of warning signals used in the series of measurements. The shortest reaction times were obtained with two warning signals; intermediate reaction times followed one warning signal; and the longest reaction times appeared with no warning signal. The second problem concerned the relationship between the reaction time and the length of interval between the two warning signals. The results showed that the shorter the interval between the two warning signals, the shorter the reaction time. The shortest reaction times were obtained with an interval of 0.5 second, medium reaction times with a 1.5 second interval, and the longest reaction times with a 2.5 second interval.

2232
Grether, W. F.
INSTRUMENT DIALS, INSTRUMENT ARRANGEMENT AND COCKPIT DESIGN. — In: Visual problems in aviation medicine, p. 54-70. Ed. by A. Mercier. Oxford: Pergamon Press, 1962.

Same as item no. 4275 in Aerospace Medicine and Biology, vol. 4: 95-96.

2233
Hawkes, G. R.
ABSOLUTE IDENTIFICATIONS OF CUTANEOUS STIMULI VARYING IN BOTH INTENSITY LEVEL AND DURATION.—Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Okla. Report no. 62-16, Sept. 1962.

The number of possible absolute identifications of electrical cutaneous stimuli varying in both stridence (subjective intensity of the tactual sensations) and duration was investigated for both experienced and naive observers. In some sessions, an equal number of stridencies and durations were used; in others there were more stridence levels than durations or the reverse. Maximum transmission of information was with combinations of four stridence levels and four durations. Experience was not a statistically significant factor when an equal number of durations and stridence levels were used. In sessions with unequal numbers of durations or stridences, experienced observers transmitted significantly more information and both groups were more efficient when identifying combinations with more durations than stridence levels. The results are compared with those obtained in similar studies. The value of 2.97 bits of this study (with combinations of four stridence levels and four durations) was just a little less than the simple sum of the performances obtained with the dimensions used singly, but it was also apparent that the dimensions are not fully interchangeable. (From the author's summary)

2234
Hixson, W. C.,
and J. I. Niven
A BIOINSTRUMENTATION CONTROL CENTER FOR THE HUMAN DISORIENTATION DEVICE.—Naval School of Aviation Medicine, Pensacola, Fla. (Project no. MR005.13-6001, Subtask 1) and National Aeronautics and Space Administration, Washington, D. C. (Order no. R-1: Final Report). Report no. 79, March 11, 1963. i+54 p.

The implementation of an integrated instrumentation system for the Human Disorientation Device, a multi-axis rotator for vestibular studies, is described. The system provides for the acquisition and analysis of biomedical data and for the correlation of precise simulator variables with the bioelectronic requirements of the experimental programs. It also provides sufficient system flexibility to permit the utilization of newly developed technological procedures and devices without extensive time lags or modifications of the original installation. (Authors' abstract)

2235
Horgan, J. D.,
and D. L. Lange
ANALOG COMPUTER STUDIES OF PERIODIC BREATHING. — IRE Trans. Bio-Med. Electronics, BME-9 (4): 221-228. Oct. 1962.

A classical clinical experiment, in which periodic (Cheyne-Stokes) breathing was induced in a normal subject by hyperventilation, was successfully simulated on the high-speed analog computer. The model, together with its underlying theory, is presented. (From the authors' summary)

2236
Johnson, L. F.,
J. R. Neville, R. W. Bancroft, and T. H. Allen
PHYSICAL TRANSDUCERS FOR SENSING OXYGEN.—School of Aerospace Medicine. Aero-

space Medical Division, Brooks Air Force Base, Tex. Aeromedical Review no. 8-63, Aug. 1963. 11 p.

Certain conditions require the control of oxygen in the air breathed, to keep it within the proper range of oxygen tension. Included among these are high-altitude aviation and operations in mines, submarines, and aerospace sealed cabins. A transducer for sensing oxygen should be specific and accurate, have a rapid response time, a wide range of detection, a long operating life, and reliability. Also, it should be continuous, automatic, small, light in weight, and easy to calibrate and operate for long periods of time. Several methods for detecting oxygen are considered as to their capability in meeting these requirements. A continuous analyzer based on polarography or electrochemical principles, because it shows great promise of fulfilling the requirements of a continuous oxygen transducer, is described in detail.

2237
Kahn, A.,
R. W., Ware, and O. Siahaya
A DIGITAL READOUT TECHNIC FOR AEROSPACE BIOMEDICAL MONITORING.—Amer. Jour. Med. Electronics, 2 (2): 152-157. April-June 1963.

Routine in-flight monitoring of several physiologic parameters measured on pilots of high-performance jet aircraft led to the development of a system for digitally recording and displaying values for heart rate, systolic and diastolic blood pressure, and respiratory minute volume. This system is used in conjunction with a telemetry link to render information concerning the status of the pilot immediately available to the monitoring physician. Included is a block diagram of the entire digital readout and recording system, diagram of the printing program of digital recorder, a sample of digital record obtained from subject in flight, and a blood pressure signal computer used to convert Korotkov sound signals for digital recording.

2238
Kaiser, E.,
and C. W. Sem-Jacobsen
"YES-NO" DATA REDUCTION IN EEG AUTOMATIC PATTERN RECOGNITION [Abstract].—Electroencephalography and Clinical Neurophysiol (Amsterdam), 15 (1): 148. Feb. 1963.

A technique for reduction and correlation of EEG data with other concomitant data is described. It is based on a successive description of EEG potentials by a certain number of "yes" and "no" answers to different criteria (height of amplitude, relation to amplitude preceding in time, duration related to the preceding time, and frequency characterization). The answers, the "yes"-"no" combinations characterizing each half-wave, are punched instantaneously producing a sequential digital information. The sequences of "words" are suitable for pattern recognition as "blocs" in a computer. The recognition takes place as a continuous comparison of incoming data to a large number of patterns, "blocs" stored in the computer. With a puncher capable of 150 "words"/sec. and an electronic switch, it is possible to analyze and compare three channels of EEG, and/or correlate two EEG channels with biological and psychological data recorded simultaneously. In simulators and space flights, EEG, ECG and other biological data will be correlated with tracking ability and performance during stress, thus correlating psychological stress tolerance with performance in laboratories and space. (Quoted in part)

2239
Kamp, A.
EIGHT-CHANNEL TELEMETERING [Abstract].—Electroencephalography and Clinical Neurophysiol. (Amsterdam), 15 (1): 164. Feb. 1963.

An 8-channel radiotelemeter was constructed, which consists of eight amplifiers, a sub-modulator and a frequency-modulated H.F. transmitter. The eight amplifiers are almost the same as those used in the 2-channel unit except that the low-frequency response has been improved. The frequency response of the complete 8-channel system is from 1 to 100 c./sec. To keep the dimensions small, the circuitry of the sub-modulator had to be as simple as possible, while retaining adequate functioning. This requirement could be met by constructing a sub-modulator which operates on the principle of pulse-position modulation. The transmitter circuit differs little from the one used in the 2-channel system. The dimensions of the apparatus are 11 x 6 x 4 cm.; the weight is 200 g. Full information and the complete diagrams are available on request. (Quoted in part)

2240
Konecci, E. B.,
G. W. Hoover, and C. E. Pruett
DESIGN STUDY FOR A CONSOLE SYSTEM. — In: Proceedings of the San Diego symposium for biomedical engineering, vol. 2: 55-67. 1962.

The criteria are discussed for the design and development of a psycho-physiological and environmental monitoring system for determining the capability of operators of vehicles to safely perform their assigned missions. Information required with regard to environmental condition, psycho-physiological condition, and vehicle condition for the monitor is outlined. The knowledge for developing adequate orientation and vehicle condition exists; however, because of rapid advances in vehicle technology, a continued development program will be required. Included are outlines of an over-all system, information requirements, display requirements, sensor requirements (environmental factors such as atmosphere, thermal conditions, acceleration), psycho-physiologic information logic, display media, control requirement, and system analysis.

2241
Kozar, A. J.
TELEMETERED HEART RATES RECORDED DURING GYMNASTIC ROUTINES. — Research Quarterly, 34 (1): 102-106. March 1963.

A telemetry system is described for recording heart beats while the subject is performing complex physical activities involving unpredictable movements. The system utilizes a wireless transistorized transmitter, an F.M. receiver and amplifier, and a two-channel paper recorder. The miniaturized transmitter is housed in a padded belt. Three surface electrodes are employed, of which two are to pick up the electrocardiographic voltage generated during the cardiac contraction. Application of telemetry to research on a subject during performance of various gymnastic routines is demonstrated, with representative figures. In addition to being novel and recording the cardiac response to physical activity, the system indicates the magnitude and reactiveness of the heart rate during this activity.

2242
Kydd, G. H.,
and K. H. Dickerson
RECORDING INSTRUMENT FOR ENVIRONMENTAL TESTING OF BIOLOGICAL SPECIMENS.—Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa. Report no. NADC-MA-6119, March 26, 1963. iii+9 p.

This report describes the modification of a strip chart recorder for use in recording, long term, the conditions of an environmental system used for subjecting animals to gas mixtures in which the oxygen content is varied. Provisions are made for recording four pressures, six temperatures and four 10-millivolt signals which in this case consist of two gas flow-meters and oxygen and carbon dioxide analysis. (Authors' abstract)

2243
Lanterman, R. S.,
A. I. Siegel, and D. G. Schultz
INVESTIGATIONS INTO FACTORS AFFECTING CONTROL ACTIVATION. IV. THE EFFECTS OF TIME STRESS ON CONTROL ACTIVATION RATE AND ERRORS. — Applied Psychological Services, Wayne, Pa. (Contract N156-40376); issued by Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AV-43001, Part 5). Report no. NAMC-ACEL-483, June 11, 1962. iv+19 p.

A study is reported of the effect of time stress on detented rotary control activation rate and errors. Normal control activation time was first obtained for four subjects on a group of detented rotary switches. Then the time allotted for completion of the control activation sequence was successively decreased in intervals of 5% of normal time and the sequence completed in these reduced allotted times. Time to activate a control was found to decrease as the allotted time was decreased to 55% of normal time. Below the 55% level, no further decrease in detented rotary control activation rate was found. The effect of reducing allotted time on error number and rate was not practically significant. Two hypotheses were advanced to account for this latter finding. (Authors' abstract)

2244
Laughlin, C. P.
IN-FLIGHT MEASUREMENT, TRANSMISSION, AND ASSESSMENT OF ASTRONAUT PHYSIOLOGIC RESPONSES. — Aerospace Eng., 21 (1): 40-43. Jan. 1962.

Application of bio-instrumentation in space flight is discussed within the broad areas of medical-safety monitoring, in-flight physiological investigation, and medical operational monitoring on longer flights.

2245
Leeuwen, W. S. van
A. Kamp, M. L. Kok, and J. Zaal
MONITORING STATES OF ALERTNESS BY TELEMETERING THE EEG [Abstract].— Electroencephalography and Clin. Neurophysiol. (Amsterdam), 15 (1): 164. Feb. 1963.

In dogs electrodes were implanted by the Sem-Jacobsen method and connected with a 34-contact amphenol plug fixed to the skull by a method developed by Van der Vliet. The electrical activity of various structures was recorded repeatedly over periods up to two years, and studied in relation to the animals' behavior. The electrical activity was tape-recorded with the 8-channel EEG magnetograph and subsequently analyzed by the continuous frequency analysis method of Bekering et al., with topographic analysis according to Petsche, and by the average response analysis method according to Dawson. The electrical activity, though varying with different states of the animal, remains remarkably similar over the entire investigatory period. Various behavioral states of alertness were distinguished, ranging from light sleep to intense alertness. Examples of the electrical activity characteristic of these behavioral states are demonstrated. Recording by cable during alertness, particularly if the animal is walking or playing, is undesirable. In these cases 2-channel radiotelemetering is necessary. A film is shown, demonstrating the technique and some of the results. As the information obtained with 2 channels is insufficient, an 8-channel radiotelemetering system has been developed. (Quoted in full)

2246
Long, F. M.
BIOLOGICAL ENERGY AS A POWER SOURCE FOR A PHYSIOLOGICAL TELEMETERING SYSTEM. — IRE Internat. Convention Record, 10 (9): 68-73. 1962.

A brief study of three biological energy sources, biological potentials and chemical gradients, blood pressure and flow, and muscular activity and motion, revealed that the first two possibilities presented difficult problems in electrode and tissue reactions and that the third possibility might have more immediate application. A theoretical study of an accelerometer system, utilizing relative motion, indicated that several milliwatts could be delivered to the damping mechanism. A test model employing a piezoelectric crystal as the mechanical to electrical converter and a tunnel diode oscillator was successfully operated at power levels of approximately one microwatt. (Author's summary)

2247
McCally, M.,
and G. W. Barnard
ENDORADIOSONDES: A STATE OF THE ART SURVEY.—Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722201). Technical Documentary Report no. AMRL-TDR-62-122, Dec. 1962. iii+9 p.

Within the last 5 years endoradiosondes or "radio pills" have been developed employing tiny transducers and transmitters which can be swallowed or implanted in man and animals. The present state of the art of these instruments, including design, construction, uses, advantages, and limitations, is reviewed. The literature in this area to date consists largely of suggestions for design principles and considerations of circuitry. There is only the barest amount of useful data on equipment performance, reliability, response linearity, frequency response characteristics, and correlation with proven systems. The endoradiosonde promises to be a useful technique in physiological instrumentation, but much basic development remains to be done before this tool can be useful to any but the bioelectronic specialist. (Authors' abstract) (35 references)

2248
Marko, A. R.,
M. A. McLennan, and E. G. Correll
A SOLID STATE MEASURING DEVICE FOR GALVANIC SKIN RESPONSE.—Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722203). Technical Documentary Report no. AMRL-TDR-62-117, Oct. 1962. iii+9 p.

The problem of monitoring galvanic skin resistance, especially when used in combination with electrocardiographic or electroencephalographic recordings, is discussed. A new approach is outlined that eliminates interference from other measurements. A small, lightweight laboratory model with low power consumption and vibration and acceleration insensitivity was built. The performance, stability, and accuracy of the model is equivalent to larger, more conventional instruments used for the same purpose. (Authors' abstract)

2249
NEW AUDIO WARNING UNIT ALSO TELLS PILOT WHEN TO GIVE UP AND GET OUT.—Amer. Aviation, 27 (2): 67-69. July 1963.

The time lag between an inflight malfunction indication and pilot response can be reduced "by as much as 100%", according to preliminary test results of a new audio type warning system. The solid-state AID (Audio Information Display) can receive information from as many as 60 sensors. It stores recorded messages and instructions to the pilot of up to 18 seconds duration on a multi-channel magnetic tape. Wording is clear and concise, and designed to stimulate rapid and accurate response. If several malfunction warnings are received at the same time, AID transmits the highest priority message to the pilot.

2250
Newman, K. M.,
and A. R. Davis
NON-REDUNDANT COLOR, BRIGHTNESS, AND FLASHING RATE ENCODING OF GEOMETRIC SYMBOLS ON A VISUAL DISPLAY. — Jour. Engineering Psychol., 1 (2): 47-67. April 1962.

In this experimental approach to the problem of symbolic encoding for visual displays, the effectiveness in terms of speed and accuracy of geometric symbol-only encoding was compared with a non-redundant symbol-plus-other-dimension(s) encoding. The encoding parameters investigated in conjunction with a systematically reduced number of geometric shapes, both with a constant amount of displayed information, were two brightness levels, three flashing rates, and three colors. The encoding variables were compared in a searching as well as in a decoding task for both single and overlapping symbols. It was shown that color encoding leads to significantly shorter response times and fewer errors than other means of encoding. However, with the exception of geometric shapes, the combination of two or three levels of three encoding dimensions in one condition is detrimental to performance, particularly when the combination includes three different flashing rates. The findings of this study also emphasize clearly the distinction between a perceptual and a learning-recall task, and point out the necessity for thorough training and careful selection of personnel with respect to the tasks they are expected to perform in handling encoded data on a visual display. (Authors' summary, modified)

2251
Newman, K. M.,
and A. R. Davis
RELATIVE MERITS OF SPATIAL AND ALPHABETIC ENCODING OF INFORMATION FOR A VISUAL DISPLAY. — Jour. Engineering Psychol., 1 (3): 102-126. July 1962.

A comparison between alphabetic and spatial encoding of information on a visual display was made along a continuum of experimental conditions progressing from pure alphabetic to pure spatial encoding. Operator performance along this continuum was evaluated in terms of speed and accuracy for both a search and an identification task. Statistical analysis of the time and error scores obtained showed that: (a) Partial spatial encoding leads to good performance, irrespective of the two tasks. (b) When the primary task was one of rapid localization of target messages, then even fairly complex spatial codes improved response speed considerably. (c) The addition of labels identifying the spatial code on the display was of significant help for some operators. (d) The design criteria for visual displays must be based on a thorough analysis of the task(s) to be performed on the display. (Authors' summary)

2252
Obermayer, R. W.,
and F. A. Muckler
PREFERENCES FOR INSTRUMENT PANEL VIEWING DISTANCE. — Jour. Engineering Psychol., 1 (4): 141-149. Oct. 1962.

The preferences for flight instrument panel viewing distance were studied in pilots and nonpilots by means of a servo-controlled instrument panel. With a total of 560 individual distance settings, the mean preferred instrument panel viewing distance was 29.19 inches. Preference settings of the individual subjects varied widely from subject to subject, but the individual subject tended to make very consistent settings throughout the experimental trials. The technique of alternating descending and ascending trials was found to affect systematically preference settings; in all cases mean settings on ascending trials were less than those on descending trials. No measurable learning or fatigue effects were noted. Nonpilots tended to be more variable in their preference settings than pilots. A subject group with psychological training tended to be more variable than a subject group with no academic psychological training. (Authors' summary, modified)

2253
Ostgaard, M. A.,
and L. M. Butsch
ADAPTIVE AND SELF ORGANIZING FLIGHT CONTROL SYSTEMS. —— Institute of the Aerospace Sciences, New York, N. Y. IAS Paper no. 62-190. 1962. [62] p. (Presented at the IAS Man-machine competition meeting, Seattle, Washington, Aug. 10-11, 1962).

The status, power, and utility of adaptive and self-organizing concepts are discussed as they relate to design of immediate and future flight control systems. The significant difference between present adaptive concepts and self-organizing concepts is the latter's learning logic and memory capability which can condition itself or be preconditioned if desired to recognize physical and dynamic characteristics and thus provide a capability for multi-parameter control, significant parameter identification, and, ultimately, self repair capability. Present adaptive concepts appear adequate to cope with immediate problems; only marginal capability is indicated, however, by preliminary analysis of future vehicle requirements. Self-organizing techniques (though in their infancy) show promise of providing means of augmenting the capabilities of adaptive techniques; more significant, however, is their capability for self-repair and self-compensating on terms of vitally needed increased reliability. (61 references)

2254
Parin, V. V.,
R. M. Baevskii, and O. G. Gazenko
[PROBLEMS OF BIOLOGICAL TELEMETRY]
Problemy biologicheskoi telemetrii.—Problemy kosmicheskoi biologii (Moskva), 1: 104-117. 1962. In Russian, with English summary (p. 116-117).

Telemetry is at present the principal method of experimentation in space biology and medicine. Special requirements of biological experiments place unique demands on telemetry and programming. Biological data suitable for telemeter transmission are discussed and examples of telemetered phonocardiograms, seismocardiograms, pneumograms, and sphygmograms from Russian satellite experiments are reproduced. The use of codes permits the simultaneous transmission of multiple data on a limited number of channels. Various coding methods and radiotelemetry systems are discussed.

2255
Pfeiffer, M. G.,
W. C. Clark, and J. W. Danaher
THE PILOT'S VISUAL TASK: A STUDY OF VISUAL DISPLAY REQUIREMENTS.—Courtney and Co., Philadelphia, Pa. (Contract N61339-783); issued by Naval Training Device Center, Port Washington, N. Y. Technical Report no. NAVTRADEVCEN 783-1, March 1963. viii+117 p.

An analysis was made of the perceptual characteristics of the pilot's visual world while performing various flight tasks. These were compared with the perceptual characteristics made available by typical nonprogrammed visual displays attached to flight trainers. An experiment was then conducted in the F-100 simulator equipped with the 151 visual attachment to determine training effects. It was determined that, even among experienced subjects, performance significantly improved, both with regard to (1) the detection of inflight emergencies and (2) the maintenance of aerodynamic stability. Recommendations are made for improvements in external visual displays to enhance the training value of flight simulators. (Authors' abstract) (33 references)

2256
Reimann, R.,
and R. Wagner
[CONTINUOUS BLOODLESS REGISTRATION OF BLOOD PRESSURE FROM THE HUMAN HEAD]
Fortlaufende unblutige Blutdruckregistrierung am menschlichen Kopfe.—Naturwissenschaften (Berlin), 50 (12): 448-449. June 1963. In German.

A technique of continual bloodless registration of blood pressure is described. Essentially it is an adaptation of a technique previously developed by R. Wagner, which was based on the principle of a "decompressed vascular wall", to the measurement of blood pressure from the arteria temporalis superficialis with its frontal and parietal branches. The advantages of this method over taking the blood pressure from the lower arm lie in the full freedom of movement of the upper and lower extremities, making it more adaptable to the requirements of occupational and aviation medicine research; and in less contamination of the data by active and passive movements, in this case restricted to chewing and swallowing which are easily recognized as such. Three circulatory reactions (Valsalva maneuver, assumption of an upright position, and the carotid sinus reflex) are demonstrated as examples of the evaluation of blood pressure registered in the head area.

2257
Rozenblat, V. V.,
and A. T. Vorob'ev
A METHOD OF PICKING UP CARDIAC POTENTIALS FROM MOVING HUMAN SUBJECTS FOR RADIOTELEMETRY.—Bull. Exper. Biol. and Med. (Consultants Bureau, New York), 52 (10): 1217-1221. May 1962.
English translation of: K metodike otvedeniia biotokov serdtsa u cheloveka pri dinamicheskoi radiotelemetrii.—Biulleten' eksperimental'noi biologii i meditsiny (Moskva), 52 (10): 119-122. Oct. 1961. In Russian.

A comparison was made of various methods of transmitting cardiac potentials by radiotelemetry; the frequency of the heartbeat was recorded by means of the radiopulsophone, utilizing the R wave of the electrocardiogram. From the data obtained, "suction" electrodes were developed, and the paste normally employed was replaced with a 10% sodium chloride solution. The area of electrode in contact with the skin was 2.85 cm.^{2}. The procedure was as follows: complete treatment of the skin was applied using Vodolazskii's method: the upper epidermis was removed carefully by means of a cream containing finely ground pumice and the skin was then degreased with ether and alcohol. The electrodes were fixed with the adhesive cleol, and suction. In this way, stable contact and a low value of contact resistance were obtained. (From the authors' summary)

2258
Rozenblat, V. V.
[ON THE RATE OF CARDIAC CONTRACTIONS UNDER NORMAL CONDITIONS OF MUSCLE ACTIVITY IN MAN (BASED ON DYNAMIC RADIOTELEMETRIC RECORDING)] O chastote serdechnykh sokrashchenii v estestvennykh usloviiakh myshechnoi deiatel'nosti cheloveka (po dannym dinamicheskoi radiotelemetrii).—Fiziologicheskii zhurnal SSSR (Moskva), 48 (12): 1454-1465. 1962. In Russian.

A device, the "radiopulsephone", was developed, which transmits radio signals from the R wave of the electrocardiogram and thus may serve as a telemetric monitor of the cardiac rhythm. A number of athletes were tested with this device. The total number of pulse counts carried out on each subject was over 10,000. Individual differences of pulse rates failed to show a precise correlation between rest and exercise values. A number of factors, such as emotion, fatigue, and environmental conditions have a considerable effect on individual pulse rates. (29 references)

2259
Schultz, D. G.,
A. I. Siegel, and R. S. Lanterman
AN INVESTIGATION INTO FACTORS AFFECTING CONTROL ACTIVATION. II. STUDIES OF TOGGLE SWITCHES: NUMBER, DENSITY AND ACTIVATION SEQUENCE. — Applied Psychological Services, Villanova, Pa. (Contract N156-40376); issued by Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AV-43001, Part 3). Report no. NAMC-ACEL-478, May 23, 1962. iv+29 p.

A series of studies is reported into the time required to activate a sequence of aircraft-type toggle switches as the number of switches, the density of the switches, and the switch activation sequence are varied. It was found that activation time for a series of toggle switches varies directly and linearly with control number and density. No relationship between activation time and activation sequence, as investigated, was found. (Authors' abstract)

2260
Schultz, D. G.,
and A. I. Siegel
AN INVESTIGATION INTO FACTORS AFFECTING CONTROL ACTIVATION. V. STUDIES OF TOGGLE SWITCHES AND ROTARY SWITCHES; CONTROL COMPLEXITY AND LINK MULTIPLICITY. — Applied Psychological Services, Wayne, Pa. (Contract N156-40376); issued by Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AV-43001, Part 6). Report no. NAMC-ACEL-487, Sept. 17, 1962. v+41 p.

Several investigations into the factors of control complexity and link multiplicity are reported in a series of primary studies of six factors purported to affect control activation speed and accuracy. Control activation time was not altered, to any practically significant degree, by variations in control complexity. Link multiplicity was found to be related, probably linearly, to control activation time. Under identical conditions of control complexity, activation time was significantly greater for the detented rotary controls employed than for the toggle switches employed. Based on the findings of the entire series of studies of this research program, it is suggested that control number, control density, link multiplicity, and time criticality be retained as factors in an over-all control activation predictive index, but that activation sequence and control complexity not be included. (Authors' abstract)

2261
Sharp, E. D.
MAXIMUM TORQUE EXERTABLE ON KNOBS OF VARIOUS SIZES AND RIM SURFACES. — Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718402). Technical Documentary Report no. MRL-TDR-62-17, March 1962. iii+11 p.

This study was initiated to determine the maximum torque a seated operator can apply in turning a knob with the bare thumb and fingertips of his right hand. Also a procedure was desired by which a given knob or set of knobs may be evaluated with respect to maximum torque exertable. A set of 60 knobs, each 1/2 inch thick, was used. The knobs had 20 diameters from 1/8 to 5 inches. For each diameter there were three different rim surfaces: smooth, rectangular-knurl, and diamond-knurl. Each of 45 subjects was tested with every diameter-surface combination. In addition, 15 of the subjects repeated the experiment. The maximum torque exertable increased with knob diameter. For all knob sizes, rectangular- and diamond-knurled knobs permitted greater torques than did smooth knobs. Very little difference in maximum torque exertable was observed between the rectangular- and diamond-knurled surfaces. (Author's abstract)

2262
Siahaya, O.,
A. R. Kahn, and R. W. Ware
A DIGITAL READOUT TECHNIC APPLICABLE TO LABORATORY AND AEROSPACE MEDICAL MONITORING OF PHYSIOLOGIC DATA.—School of Aerospace Medicine, Brooks Air Force Base, Tex. (Task no. 793002). Technical Documentary Report no. SAM-TDR-62-139, Feb. 1963. iii+14 p.

A technique is described for digital readout of systolic and diastolic blood pressure, heart rate, and respiratory minute volume, applicable to wire telemetry in the laboratory as well as wireless telemetry from aerospace vehicles. General description of the technique and specific construction details are given. (Authors' abstract)

2263
Siegel, A. I.,
D. G. Schultz, and R. S. Lanterman
INVESTIGATIONS INTO FACTORS AFFECTING CONTROL ACTIVATION. III. ROTARY SWITCHES;

NUMBER AND ACTIVATION SEQUENCE. — Applied Psychological Services, Wayne, Pa. (Contract N156-40376); issued by Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Project no. TED NAM AV-43001, Part 4). Report no. NAMC-ACEL-479, June 11, 1962. iv+21 p.

Studies of the effects of varying the number of controls and the control activation sequence on the time required to set detented rotary switches are reported. Although activation time was found to be significantly increased when the number of controls in the panel was increased, the activation sequence, or response pattern, had no effect on the time required to set a series of controls. These findings are in agreement with the results of analogous experiments involving toggle switches. A comparison between the two control types employed, toggle switches and detented rotary controls, indicated that, for a given number of control settings or functions, activating the detented rotary switches required approximately twice as long as the toggle switches. (Authors' abstract)

2264
Siegel, A. I.,
D. G. Schultz, and R. S. Lanterman
FACTORS AFFECTING CONTROL ACTIVATION TIME. — Human Factors, 5 (1): 71-80. Feb. 1963.

Control activation time as a function of control number, control density, activation sequence, control complexity, and link multiplicity was investigated. Although activation time was found to be significantly related to each factor, the number, density, and link multiplicity factors were considered to exert the greatest operational significance. These data will be applied in the eventual evaluation of aircraft cockpit control panels, proposed or extant, with respect to their suitability for pilot operation. Included are representative figures and graphs. (Authors' summary, modified)

2265
Simons, D. G.
USE OF PERSONALIZED RADIO TELEMETRY TECHNIQUES FOR PHYSIOLOGICAL MONITORING IN AEROSPACE FLIGHT. — Jour. Mississippi State Med. Assoc., 3 (9): 413-420. Sept. 1962.

A newly developed technique of transmitting physiological parameters by radio telemetry directly from an individual wearing a low-power miniature transmitter is described and diagrammed. This method, in comparison to the classical "wired into place techniques", eliminates any physical connection to the recording apparatus and permits complete freedom of motion of the monitored individual. Predominant central nervous system function is reflected by the following parameters: electroencephalography, eye motion, electromyography (voluntary nervous activity); respiration (mixed nervous activity); and electrocardiography, electrodermal responses, and body temperature (autonomic nervous system activity). Blood pressure sensing equipment has not been sufficiently miniaturized to be included. Figures are provided of the equipment, and of various graphic registrations.

2266
Simons, D. G.,
and N. R. Burch
TELEMETRY AND AUTOMATIC ANALYSIS OF THE ELECTROENCEPHALOGRAM UNDER SIMULATED FLIGHT CONDITIONS [Abstract]. — Electroencephalography and Clinical Neurophysiol. (Amsterdam), 15 (1): 165-166. Feb. 1963.

A 12-hour sleep run is presented, in which the left parieto-occipital EEG was telemetered over short distances. A 6-channel FM/FM "Biotel" unit transmitted respiration, EKG, basal skin resistance, galvanic skin response and body temperature. Three hours of EEG record from an early morning portion of the run was analyzed by the Riehl technique of U_a as well as by the technique of period analysis. Comparison of the two types of analysis indicates that the U_a factor is extremely sensitive to transition from resting to light sleep and resting to arousal. Although period analysis shows less dramatic changes during these transition times, the EEG reflection of state of consciousness can be quantitatively followed throughout the entire run. Ten-second U_a sums have been computed for the entire 24-hour flight simulator run on the left parieto-occipital EEG of a MATS pilot. Several 2-hour legs of the flight are presented to indicate that the 10th leg, when the pilot was fatigued, compared to the second leg, when he was "fresh", shows much less EEG arousal throughout and markedly less during cruise time as compared to descent and landing. The results obtained in twelve 24-hour recordings of the EEG demonstrate that personalized radio telemetry is practical under simulated field conditions and that automatic analysis of the EEG offers a practical method of monitoring long term EEG arousal and sleep. (Quoted in part)

2267
Spencer, J.
POINTERS FOR GENERAL PURPOSE INDICATORS. — Ergonomics (London), 6 (1): 35-49. Jan. 1963.

This paper surveys the somewhat limited evidence available regarding the effects on performance of different designs of pointers for use with instrument scales. Longer pointers, up to the radius of a circular scale, have been found to give better results than shorter. The pointer tip should closely approach the scale marks. Width and shape of pointer usually have little effect provided the tip is pointed and the pointer makes good contrast with the face of the instrument. Apart from this contrast, color has little effect. The effect of placing the pointer inside or outside a circular scale is small if the instrument is used for precise quantitative readings, but an inside pointer may be superior for rough check-readings made quickly. The design variables which are important differ somewhat according to which type of reading is required. Brief particulars of two hitherto unpublished experiments are given in an Appendix. (Author's summary)

2268
TECHNIQUES OF PHYSIOLOGICAL MONITORING. VOL. I. FUNDAMENTALS. — RCA Service Co., Camden, N. J. (Contract AF 33(616)-7750); issued by Aerospace Medical Division. Biomedical Lab.,

Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722203). Technical Documentary Report no. AMRL-TDR-62-98 (I), Sept. 1962. x+120 p.

This volume is the first of a three-volume handbook covering the applications of electronics in monitoring bioelectric physiological responses. The fundamental concepts and methods presented in this volume form a foundation for the detailed technical discussions in the succeeding volumes and, it is hoped, provide a common language and basis of understanding between the physiologist and electronic engineer engaged in this field. The data obtained by monitoring physiological responses in varied environments can be used to improve the efficiency and increase the safety of a human subject in aircraft and spacecraft. (Author's abstract) (69 references)

2269
Utterstrom, J. R.
PILOT CONSIDERATIONS IN TRANSPORT AUTOPILOT DESIGN.—Institute of the Aerospace Sciences, New York, N. Y. IAS Paper no. 62-185, 1962. 21 p. (Presented at the IAS Man-machine competition meeting, Seattle, Washington, Aug. 10-11, 1962).

Factors contributing to autopilot development since World War II are presented preceding presentations of some technical and human factors which influence autopilot design and discussions of pilot-autopilot relationship involving pilot preference, acceptance, capability, safety, and cost. Divergent points of view are also presented regarding which should predominate, the pilot or the autopilot. It is suggested that the pilot should remain dominant through all flight phases since autopilots do not enjoy overwhelming pilot confidence and technical skill is no substitute for intelligence.

2270
Wallman, H.,
J. L. Dobson, V. A. Speziali, A. E. Rabe, R. J. Nickerson, and R. R. Cordeiro
RESEARCH AND DEVELOPMENT OF A LIQUID-GAS CONTACTOR FOR PHOTOSYNTHETIC GAS EXCHANGERS.—General Dynamics Corp. Electric Boat Div., Groton, Conn. (Contract AF 33(616)-8008); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 716403). Technical Documentary Report no. AMRL-TDR-62-101, Sept. 1962. v+37 p.

A liquid-gas contactor and liquid-gas separator system capable of operating as a photosynthetic gas exchanger was designed, fabricated, and tested. The system was designed to handle the oxygen requirements of one man and to be capable of operating under weightless conditions. It consists of four major components: (1) a multi-pass light chamber, (2) an agitated liquid-gas contactor, (3) a centrifugal liquid-gas separator, and (4) an instrument console. Based on the growth rate of algae, the unit produced up to 1.5 standard cubic feet/hour of oxygen under normal gravity and should give satisfactory performance under weightless conditions. (Authors' abstract, in part)

2271
Ware, R. W.,
and A. R. Kahn
AUTOMATIC INDIRECT BLOOD PRESSURE DETERMINATION IN FLIGHT. — Jour. Applied Physiol., 18 (1): 210-214. Jan. 1963.

A modified Korotkov method for the automatic measurement of systolic and diastolic blood pressures in occupants of ultra-high performance aerospace vehicles is described. The apparatus, illustrated and described, consists of an electromechanically programmed bypass-type gas pressure regulator of fast response time, cuff with pressure programmer and transducer, microphone retention pad, voltage amplifier, oscillograph, and telemetry equipment. After installation of the apparatus in the F-100F research aircraft, 874 separate blood pressure recordings were made during 19 flights, with 85% successful recordings of systolic and diastolic pressure. In 5.4% of the recordings neither systolic nor diastolic could be obtained because of extreme aircraft noise or violent arm motion of the subject, and in 2.2% either systolic or diastolic alone was unreadable. Aerobatic maneuvers producing ±4 g and zero g did not prevent blood pressure recordings. Although primarily developed for aerospace medical use, the method can be successfully used with subjects performing work on a treadmill, in altitude chambers, and in water immersion experiments.

2272
Weiss, R.
DISPLAY SYSTEMS FOR SUB- AND ZERO-GRAVITY FLIGHT.—Lear Siegler, Inc., Grand Rapids, Mich. (Contract AF 33(657)-7199); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7184, Task no. 718405). Technical Documentary Report no. AMRL-TDR-63-11, Jan. 1963. x+54 p.

A study was performed of the controls and pilot displays used to fly a C-131B and KC-135 aircraft in a Keplerian trajectory to create zero-gravity conditions. Evaluation criteria for this maneuver were proposed and applied to two basic instrumentation systems which were developed. An analog simulation was formulated and these results will be used to further improve the systems. Recommendations are made for improved instrumentation which should enable consistent flights of 10 seconds at zero-gravity plus or minus 0.005 g. (Author's abstract) (26 references)

2273
Wu, W. L. S.
A PROPOSED MEDICAL INSTRUMENTATION SYSTEM FOR EARLY MANNED RESEARCH SPACECRAFT AND SPACE LABORATORY. — In: Proceedings of the San Diego symposium for biomedical engineering, vol. 2: 75-92. 1962.

A description, with diagrams, is presented of a hybrid radio-frequency (RF) and hard-wire (HW) system for the monitoring of biomedical and bioecological parameters specifically selected for early manned research spacecraft and space laboratories. These parameters include electrocardiography, respiratory rate and depth, transverse acceleration, galvanic skin response, electromyography, plethysmography, phonocardiography, pressure-suit total pressure, carbon dioxide partial pressure, body temperature, oximetry, electroencephalography, and voice. Only four to eight parameters are monitored at any one time, plus voice and phonocardio-stethoscopic sounds, depending upon the four operating modes, RF or HW, and with the astronauts in shirt sleeves or in pressure suits. The system has the physical shape of a "Belt-Pack". In addition a central control and a monitoring console are described. (Author's abstract, modified)

d. Simulators and Analogs

2274
Alderson, S. W.
"A HUMAN . . . JUST WON'T TAKE THE ABUSE."—Grumman Horizons, 1963: 20-23. Summer 1963.

The Alderson Research Laboratories and Grumman Aircraft Engineering Corporation have joined forces in the production of anthropomorphic dummies. The former organization has been developing dummies since 1952. The first joint product of these two groups is called Gard (Grumman-Alderson Research Dummy) and contains a 12-channel instrumentation package designed by Grumman. Gard was developed as a test subject for a U. S. Navy seat-ejection program. One project will use Gard as a "crewman" to be ejected from spacecraft. Several "Plastinauts" to be put in orbit have been developed by the Alderson Research Laboratories for the U. S. Air Force.

2275
Bates, H. J.
DESIGN STUDY FOR AN ACCELERATION RESEARCH DEVICE.—Rucker Co., Oakland, Calif. (Contract AF 33(616)-7536); issued by Aerospace Medical Division. Biophysics Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7222, Task no. 722202). Technical Documentary Report no. AMRL-TDR-62-113), May 1963. ix+257 p.

Acceleration patterns in present and imminent aerospace weapon systems cannot, with existing machines, be reproduced adequately with respect to magnitude, rate of change, required levels of various artifacts, and combinations of other stresses. This report introduces an advanced centrifuge design which may be built utilizing present-day engineering and manufacturing techniques. (From the author's abstract) (62 references)

2276
Beson, E. E.,
and M. P. Dickey
LIFE SUPPORT SYSTEMS EVALUATOR INSTRUMENTATION. — Minneapolis-Honeywell Regulator Co., Minnesota (Contract AF 33(616)8349); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637305). Technical Documentary Report no. AMRL-TDR-62-90, Aug. 1962. v+52 p.

The Life Support Systems Evaluator Console was built to monitor and record the changes in environmental parameters occurring during the test of men and life systems in an evaluator or space flight test chamber. The system design embodies a four-module steel enclosure or console, with turret top section, work table surface, and rollaway table section, which contains the complete monitor system. The evaluator instrumentation includes sensors, indicators, and recorders which enable the investigators to monitor the following: (1) absolute and differential pressures at six different stations in the test chamber; (2) temperatures at 24 stations within the forward and aft sections of the chamber; (3) relative humidity in forward and aft sections of the test chamber; (4) analyses of chamber atmospheric composition; and (5) continuous recording of the variables. (From the authors' abstract)

2277
David, H. M.
AF BUILDING $1.7-MILLION SIMULATOR. — Missiles and Rockets, 10 (18): 40. April 30, 1962.

A description is given of a new dynamic escape simulator to be built by 1963 at the Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio. The simulator will combine an altitude chamber and a centrifuge of 20 g capacity. The cab can be rotated or oscillated in relation to movements of the main arm. High-speed tumbling, vibrations, oscillations, and decelerations can be studied separately and sequentially. Cabs may be interchanged allowing various types of instrumentation to be used. A diagram is given showing the types of movement in the simulator.

2278
Dines, J. H.,
and F. A. Hitchcock
A CLOSED SYSTEM FOR PROLONGED EXPOSURE OF SMALL ANIMALS TO ARTIFICIAL ATMOSPHERES.—Jour. Applied Physiol., 18 (3): 633-636. May 1963.

The systems (one experimental and one control) described are used to study the prolonged effect of artificial atmospheres on small animals. They are so constructed that the animals can be examined, excreta collected, oxygen consumption measured, and exchange of materials accomplished without altering the animals' environment. Although the pressure within the control system varies with the ambient pressure changes at ground level, the pressure within the experimental system can be held constant at any predetermined value between 730 and 196 mm. Hg. Diagrams are included for experimental closed system within altitude chamber, evacuation system, nonspill feeders, and drinking box.

2279
Feder, H. C.
THE FLYWHEEL AS A CENTRIFUGAL ACCELERATOR.—Aerospace Medical Division. Aeromedical Research Lab. (6571st), Holloman Air Force Base, New Mexico. Technical Documentary Report no. ARL-TDR-63-9, April 1963. v+15 p.

A flywheel accelerator is investigated as a component of a 160- to 200-foot diameter circular track. The 22-spoke, box-construction flywheel could be made from commercially available steel plates. Based on optimal design conditions, the upper application limit, governed by the welding property of the material used, was found to be a test weight capacity of 230,000 pounds at a level of 300 g. The discussion, based on a linear dependence of flywheel weight, moment of inertia, power and cost on test weight, and cross-section of box members at constant radius and stress, shows that the lower application limit of the flywheel reaches far into the application range of proposed arm-type centrifuges and that the flywheel is a logical necessity if the test capacity of existing centrifuges needs to be exceeded. (Author's abstract)

2280
Gans, P.
EXPOSURE CHAMBER FOR ANIMALS AT CHANGED ATMOSPHERIC CONDITIONS.—Jour. Applied Physiol., 18 (5): 1035-1036. Sept. 1963

An airtight exposure chamber is described in which mice can be kept continuously in an atmosphere with a high carbon dioxide percentage, or with a low or high oxygen percentage. Advantages of the apparatus described are the absence of moving parts inside the chamber and, in the experiments with a low or high percentage of oxygen, the absorption of carbon dioxide and water outside the chamber, permitting the continuous treatment of the animals. (Author's abstract)

2281
Glushkov, V. M.
[MODELING OF THOUGHT PROCESSES]
Modelirovanie myslitel'nykh protsessov.—Priroda (Moskva), 52 (2): 3-13. Feb. 1963. In Russian.

The author considers possibilities of mechanical replication of thought processes, and discusses the following topics: model of the human brain, alogarithmic principles of thought description and coding, possibilities to automate creative processes, modeling of visual recognition, and experiments in the "teaching" of machines. It is concluded that cybernetics offers wide opportunities for the production of thought process analogs.

2282
Hnilicka M. P.,
and K. A. Geiger
SIMULATING INTERPLANETARY SPACE.—Astronautics and Aerospace Eng., 1 (6): 31-35. July 1963.

New techniques are discussed which are involved in the development of an ideal space chamber capable of simulating celestial radiation, absorbing reflected and re-radiated heat, and establishing a molecular sink for rejected gases. Various representative illustrations, charts, and diagrams are included.

2283
Hoeft, L. O.,
and V. E. Sackschewsky
A PRELIMINARY STUDY OF THE SERVO PROPERTIES OF THE GASTROCNEMIUS MUSCLE OF THE CAT.—Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th). Wright-Patterson Air Force Base, Ohio (Project no. 7232, Task no. 723201). Technical Documentary Report no. AMRL-TDR-62-108, Nov. 1962. iii+18 p.

A variable-impedance muscle stimulator was developed for use in investigating the control functions of biological servomechanisms. Preliminary investigations were concerned with the properties of the gastrocnemius muscle reflex of the cat, which represents a simple servo system. These investigations showed that the muscle reflex seems to be dependent for the most part on only a few parameters: resting tension, amplitude of the stimulus, and rate of onset of the stimulus. More complicated systems, in particular some of the control systems of man, will be investigated in the future. This type of study is useful to systems design engineers, because biological servomechanisms offer an infinite number of prototypes that can be investigated to find out how to build accurate, reliable servomechanisms able to maintain their control function while operating into a wide range of loads. (Authors' abstract)

2284
Johnson, H. I.
SIMULATION AND TRAINING FACILITIES.—Astronautics and Aerospace Eng., 1 (1): 82-86. Feb. 1963.

Project Gemini and Apollo flight trainers aim to: (1) familiarize the flight crew with the appearance and operational modes of all instrument displays, switches, and control systems in the spacecraft; (2) acquaint the crew with many expected out-of-the-window views; (3) train the crew to detect and correct anticipated systems failures; (4) acquaint the crew with the dynamic response characteristics of the spacecraft, as shown by both flight instruments and out-the-window displays for spacecraft motions caused either by automatic or manual control systems; and (5) familiarize the crew with over-all mission timing and allow crew members to practice tasks in a specific flight plan. Briefly discussed are Gemini and Apollo part-task trainers, centrifuge simulations, egress trainers, terminal-phase trainers, Gemini docking simulator, and systems trainers.

2285
Kotanchik, J. N.,
and H. K. Strass
FACILITIES FOR MANNED SPACECRAFT DEVELOPMENT: MSC TEST FACILITIES.—Astronautics and Aerospace Eng., 1 (1): 78-81. Feb. 1963.

A review, with illustrations, is presented of the Space Environment Simulation Facility under construction at Houston, Texas. The facility will contain two space chambers, the larger for space and lunar-surface environment simulation, and the smaller for astronaut training. The area between the chambers will be used to prepare spacecraft for environmental tests.

2286
Kurtzberg, J. M.
DYNAMIC TASK SCHEDULING IN FLIGHT SIMULATORS.—Burroughs Corp., Paoli, Pa. (Contract AF 33(616)-8062); issued by Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force

Base, Ohio (Project no. 6114, Task no. 611409). Technical Documentary Report no. AMRL-TDR-63-17, Feb. 1963. iv+45 p.

The possible mechanization of dynamic scheduling in flight simulators, i. e., developing a task-sequencer is considered. Attention is focused on the possible application of some of the heuristic programing techniques and an evaluation of their worth for that specific purpose is made. Two main applications for a task-sequencer are defined. The first involves the traditional training of students (flight crews) for flight vehicle operation, termed the operation-teaching mode. The second is for the development of tactical skill, i. e., crew decision-making capabilities, termed the tactic-teaching mode. Algorithms for task sequencing in real time are formulated for both of these classes of applications. The only possible benefits in employing a heuristic programing scheme appear to exist when it is used for an ancillary role in the tactic-teaching mode. A procedural training model is developed in detail for the operation-teaching mode. This includes development of specific task flow diagrams and associated scoring charts. Recommendations for further work are given. (Author's abstract)

2287
Nelson, J. D.
LABORATORY SIMULATION OF LUNAR SURFACE CONDITIONS.—Jour. Environmental Sciences, 6 (4): 31-33. Aug. 1963.

The behavior of lunar soil is influenced by solar radiation, extreme temperatures, meteoritic impact, etc., making simulation of an accurate and complete lunar environment difficult. It is postulated that the surface of the moon is covered by a layer of soil varying in thickness from a few inches up to many feet. The particle size of this soil may vary from very fine dust size particles to coarse sand or gravel size, with the major portion of the spectrum being in the fine dust range. Selection of a material to simulate the lunar soil can have a significant effect on experimental results. The pressure in the pores of the soil may be influenced by the amount of time the sample is exposed to vacuum and will be higher than that which is recorded in the vacuum chamber. The nature and behavior of the lunar soil cannot be determined conclusively until man has actually been placed on the moon.

2288
Pearson, R. G.
THE USE OF SIMULATORS FOR BIOMEDICAL RESEARCH.—Navigation, 9 (4): 329-333. Winter 1962-1963.

In order to evaluate the use of simulators in aeromedical work the author discusses four of the parameters to be studied. These are: (1) the basis of civil aeromedical research in navigational problems, (2) factors affecting navigator performance, (3) methods of studying navigational performance factors, and (4) the problems in using simulators in biomedical research. It is thought that with some limitations simulators have their place in aeromedical work, but other methods of testing should not be overlooked.

2289
Sadoff, M.,
and C. W. Harper
A CRITICAL REVIEW OF PILOTED FLIGHT SIMULATOR RESEARCH. —— Institute of the Aerospace Sciences, New York, N. Y. IAS Paper no. 62-186, 1962. [46] p. (Presented at the IAS Man-machine competition meeting, Seattle, Washington, Aug. 10-11, 1962).

Results of a number of piloted-simulator investigations are examined to assess the utility of simulators for defining and solving pilot-vehicle integration and control problems of interest for various types of aircraft and spacecraft. Comparative appraisals, obtained in various ground-based simulators and in flight, are used to indicate the degree of simulator sophistication required, that is, the visual and motion information cues needed for routine handling qualities evaluations and specific control problem research on conventional and advanced vehicles. (Authors' abstract) (28 references)

2290
Scano, A.
[THE HUMAN CENTRIFUGE: INSTRUMENT OF RESEARCH AND TRAINING] La centrifuga umana: strumento di indagine e di addestramento. —— Rivista di medicina aeronautica e spaziale (Roma), 25 (1): 121-130. Jan.-March 1962. In Italian.

The human centrifuge was developed to simulate accelerations of various speeds, directions, and durations analogous to those of aircraft in order to study the physiological reactions of humans exposed to them. The first centrifuge of note, however, was used to treat mental disorders. It was built in 1818 in a Berlin psychiatric clinic, rotated at 40-50 turns per minute, and managed to attain 5 g at the outer arm level. In 1877, Salathé used a small centrifuge of 1.5 meters in diameter for acceleration studies in small animals, and in 1898, Wenusch constructed a centrifuge with a maximum velocity of rotation to about 8 g, also for treating mental disorders. It was not until 30 years later in Germany and in the United States that the first human centrifuge for research purposes was developed. In 1938, The Center of Studies and Research in Aviation Medicine, Torino, constructed the first Italian centrifuge which attained 20 g. The latter apparatus is described and illustrated, and its modifications (eventually between 1 and 33 g was attained) and research possibilities are explored.

2291
Smith, Paul E.
ANALOG SIMULATION OF THE PHYSIOLOGICAL RESPONSES OF MEN WORKING IN HOT ENVIRONMENTS. —— In: Proceedings of the San Diego symposium for biomedical engineering, vol. 2: 117-125. 1962.

A dynamic mathematical model of the human heat transfer system capable of exhibiting both transient and steady-state responses is described and diagrammed. This model includes the following factors: (1) the distribution of metabolic heat generation; (2) convective transport of heat by the blood stream; (3) conductive transfer of heat through the tissues; (4) storage of heat in the tissues; (5) loss of heat through the respiratory tract; and (6) loss of heat from the skin by radiation, conduction, and evaporation. The rationale of the model is presented, together with an indication of the method of programing used. Techniques of validating the model by comparison with data obtained on human subjects are discussed and the results presented. (Author's abstract, modified)

2292
[A SPACE FLIGHT SIMULATOR] Un simulateur de vol spatial. —— Homme et l'espace (Lausanne), no. 13: 28. July 1962. In French.

This simulator (developed by Ling-Temco-Vought, Inc.) reproduces all phases of a space mission such as launch, orbital flight, rendevous with a space station, maneuvers, re-entry, and landing. It can be used for research and development of aerospace vehicles, for the study of various space-flight techniques, and for instruction and training of astronauts. It also serves to study the physiological effects of space flight and to determine human safety limits of various space flight conditions.

2293
SPACE SIMULATION FACILITIES. —— Jour. Environmental Sci., 5 (2): 23-24. April 1962.

The world's largest combined environmental test facility being built at Edwards Air Force Base, California, features a 30 g centrifuge with a load capacity of 30,000 pounds. The environmental complex is designed to assume any combination of acceleration, vibration, temperature, humidity, and altitude. It integrates in one test system a large centrifuge acceleration test machine, vibration exciter, and temperature and vacuum chamber. Vibration stresses and g forces encountered by missiles and spacecraft during take-off and flight will be simulated by a shaker integrally mounted to the test chamber. A tabulated comparison of thermal vacuum test facilities and the space environment simulator is presented.

2294
SURVEY OF FACILITIES FOR SPACE ENVIRONMENT SIMULATION. —— Aerospace Industries Association of America, Inc. Aerospace Research and Testing Committee (ARTC Project no. 6-60). [v+527] p. ATC Report no. ARTC-30, April 1962. Washington, D. C.: National Standards Association, Inc.

The main body of the report is separated into 11 sections including acoustic test facilities, vibration test facilities, human factors facilities, and general environmental test facilities. These sections explain the function of specific equipment for space environmental simulation. When practical a summary table has been added to the section giving general characteristics of the equipment. (Author's summary, modified)

2295
Uhr, L.
"PATTERN RECOGNITION" COMPUTERS AS MODELS FOR FORM PERCEPTION. —— Psychol. Bull., 60 (1): 40-73. Jan. 1963.

This paper reviews computer simulations of pattern recognition to indicate their relevance as models of form perception. The different types of programs are discussed and compared, and an attempt is made to assess their relative abilities. An attempt is made to exhibit certain similarities underlying superficially different approaches. Various specific simulations are compared with models and suggestions in the psychological literature. (Author's summary) (159 references)

2296
Weinflash, B.
INTERNAL ENVIRONMENTAL SIMULATOR FOR A MAN-MADE SYSTEM. —— Jour. Environmental Sci., 5 (1): 10-13, 22-23. Feb. 1962.

With the increasing number of situations calling for use of closed environmental systems, there is a need for an environmental simulator for training. Training requirements are stated, and the description of a simulator is given. The simulator is composed of a command module and a mission module. The latter has facilities for food preparation, hygiene, water recovery, oxygen regeneration, and air conditioning, and each of these systems is discussed. The training capability and research capability of the simulator, as well as a program schedule leading to installation and utilization are given. Diagrams of the command module and mission module are included.

e. Airplane and Space Cabins and Cabin Equipment

2297
Andersen, A. A.,
and M. R. Andersen
A MONITOR FOR AIRBORNE BACTERIA. —— Applied Microbiol., 10 (3): 181-184. May 1962.

A unique agar drum sampler is described which indicates, continuously, the number of viable bacterial particles per unit volume of air at the time and point of sampling. By selection of the timer and the sampling rate the sampler is suitable for quite a wide range of concentration and time. An impaction line of 484 inches greatly increases the capacity of this device over slit samplers and other instruments designed to give time-concentration data for viable airborne particles. This sampler should prove useful for: (1) monitoring airborne bacteria in hospitals, public places, and food and industrial plants; (2) decay rate studies of bacterial aerosols; (3) evaluation of aerial germicides; (4) determination of effectiveness of air conditioning systems in removing airborne bacteria; and (5) many other studies in aerobiology. (Authors' abstract)

2298
Brehaut, W. H.
DESIGNING PASSENGER SEATS FOR CRASH SURVIVAL. —— SAE Jour., 70 (5): 59-60. May 1962.

Exhaustive and costly tests have developed four ground rules for designing a seat to keep the passenger safe: (1) a seat belt to airframe structural chain must be maintained throughout the crash; (2) structural materials must be ductile to absorb energy, and must be secured mechanically, by rivets or bolts rather than by welding; (3) seat backs and other nearby objects must be de-lethalized; and (4) an absorbing device to attenuate some of the high peaks of crash energy should be developed and tested.

2299
Campbell, T. C.,
and G. F. Sharples
AIRCRAFT COCKPITS.—U. S. Patent 3,079, 112, February 26, 1963.

A pilot seat assembly adjustable to two flight positions is described and diagrammed. Adjustment of the seat to an upper position affords the pilot outward vision for the visual control of the aircraft during take-off, refueling in flight, landing, and taxying, and a lower position for the performance by the pilot of ancillary operational duties, navigation, and instrument flying.

2300
Corteel, A.,
and J. Colin
[PRELIMINARY STUDIES OF ATMOSPHERIC MOISTURE ON COMMERCIAL FOUR-ENGINE JET AIRCRAFT] Étude préliminaire de l'hygrométrie à bord d'un quadriréacteur civil.—Revue de médecine aéronautique (Paris), 2 (8): 395-399. Aug.-Sept. 1963. In French.

When psychrometric readings were taken, the amount of atmospheric moisture inside a four-engine jet plane was found to decrease with increasing altitude. The low humidity did not reach a stable level but fluctuated with changes in altitude and with the slow progressive dehydration of the aircraft interior. With many personnel members on board, the pulmonary transpiration by them was sufficient to increase moisture almost to saturation. By skin transpiration the average man lost water at the rate of 35 to 60 g. per hour at 33° C. The water lost by the men was rapidly regained after the flight.

2301
David, H. M.
LIFE SUPPORT "KNOW HOW" UPDATED. — Missiles and Rockets, 10 (12): 27. March 19, 1962.

Designers of environmental control requirements for space vehicles must first determine the environmental requirements of the equipment and the physiological requirements of the space crew. Short-duration missions appear to present more problems in the estimation of human requirements due to emotion and stress. On longer missions, a percentage can be arrived at. Long-duration missions present problems in the design of atmospheric composition control and thermal comfort control. A graph shows the tolerable, marginal, and intolerable limits of temperature and humidity.

2302
Hasbrook, A. H.,
and J. C. Earley
FAILURE TO REARWARD FACING SEAT-BACKS AND RESULTING INJURIES IN A SURVIVABLE TRANSPORT ACCIDENT. — Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Oklahoma. Report no. 62-7, April 1962. 11 p.

A case is described and illustrated in which modification of attachment fittings and incorrect installation of several sets of armrests on rearward facing seats permitted failure of the seat-backs in a moderate-force accident. This failure reduced the desired degree of occupant protection and restraint and probably was a factor in producing the spinal injuries sustained by several occupants of the aircraft. It is recommended that no field alterations be made to any aircraft equipment, including seats, without first obtaining approval of the manufacturer or authorized engineering personnel.

2303
Jury, W.
FOUR HOURS OF AIR.—Boeing Mag., 33 (4): 10-12. April 1963.

Three subjects spent 30 days in an air-tight missile-shaped chamber in order to evaluate a Boeing chemical oxygen-regeneration system. When fully developed, the system demonstrated that the need for spacecraft to carry large stores of oxygen for extended space flight might be eliminated. Essential parts of the system are clay-like molecular sieves for collecting carbon monoxide from air, a reactor for producing water from carbon dioxide and hydrogen, and an electrolytic cell which forms oxygen and hydrogen by breaking down water molecules into these basic elements. No attempt was made to recycle wastes. Studies were also made of the airmen's behavior during the test period. Each man spent four hours at his duty station in the cockpit, and eight hours off-duty in a rear compartment.

2304
Miller, R. A.,
and S. Halpert
A FOOD REFRIGERATION AND HABITABLE ATMOSPHERE CONTROL SYSTEM FOR SPACE VEHICLES, DESIGN, FABRICATION, AND TEST PHASES.—General Electric Co., Philadelphia, Pa. (Contract AF 33(616)-6902); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637303). Technical Documentary Report no. AMRL-TDR-62-149, Dec. 1962. vi+198 p.

The purpose of this development project was to design, fabricate, and evaluate a food refrigeration and habitable atmosphere control system which will support a three-man crew for an extreme altitude mission of 14 days and have additional capabilities for the storage, heating, and chilling of recovered water. The feasibility-study and design-study phases of the program indicated that a flight-optimized system (i.e., a system with minimum power, weight, and volume characteristics) would be a system which utilizes a direct radiation-to-space concept to remove excess heat from the confines of a space vehicle. The equipment and systems were fabricated to assure their operability under the following extremes of environment: (1) cabin pressure between 0.5 to 1.0 atmosphere, (2) normal gravitational conditions and a weightless condition as well as acceleration forces of up to 8 g. (Authors' abstract) (72 references)

2305
Parker, F. A.,
and D. R. Ekberg
SELECTING THE SPACE-STATION ATMOSPHERE.— Astronautics and Aerospace Eng., 1 (7): 47-52. Aug. 1963.

The selection of an atmosphere for a long-term orbital space station is discussed as it relates to oxygen partial pressure, diluent-gas considerations, space-suit considerations, and temperature, humidity, and carbon dioxide. An atmosphere containing nitrogen as a diluent, a partial pressure of oxygen between 160 and 175 mm. Hg, and a total pressure between 350 and 380 mm. Hg is suggested which satisfies the basic ground rules for the internal atmosphere of a manned orbital space station. In addition, a maximum pCO_2 range of 5-8-mm. Hg and a pH_2O of 5-15 mm., with a dry-bulb atmospheric temperature range of 70-80° F., are recommended. (Authors' summary, in part)

2306
Popma, D. C.
LIFE SUPPORT FOR SPACE STATIONS. — Astronautics, 7 (9): 44-47. Sept. 1962.

Investigations are discussed of three kinds of life support equipment: a carbon dioxide removal system utilizing molecular sieves, a compression-distillation water reclamation system, and an oxygen reclamation system. Instrumentation of these systems is described, evaluated, and diagrammed. To conduct tests a closed environmental test chamber with controlled atmospheric variations, a waste management system, and a humidity control and zero-g water separation system were used. One goal of this series of evaluations was not directly concerned with the operation of the systems, but rather with data gathering and presentation for the crew and for telemetering to the ground. The need is mentioned for an accurate carbon dioxide partial-pressure sensor and a low-level water vapor sensor.

2307
Saunders, R. A.
ATMOSPHERIC CONTAMINATION IN THE SPACE CABIN. — Report of NRL Progress (Naval Research Lab., Washington, D. C.), 1963 (Jan.): 7-11.

Organic contaminants dispersed in the atmospheres of Mercury spacecraft are adsorbed by activated charcoal in the environmental control system. The contaminants are later recovered from the charcoal in the form of a complex mixture by a process of vacuum desorption. The small volume of the space cabin and the low concentration of the various contaminants result in the recovery of very small quantities of contaminant mixture. The identification of the components in this mixture and the determination of their concentration in the original atmosphere require the use of microtechniques. The contaminant mixture is separated into its components by means of an analytical gas chromatograph. The individual components are recovered from the effluent stream of the chromatograph with a novel fraction collecting system and their identity is established by means of infrared and mass spectral techniques. A summary is given of 27 organic contaminants recovered from several spacecraft atmospheres. (Author's abstract)

2308
Schaefer, K. E.,
and J. H. Dougherty
INTERACTION OF AEROSOLS AND AIR IONS.— Naval Medical Research Lab., New London, Conn. (Research Project no. MR005.14-3300-5.05). Report no. 380, March 29, 1962. 15 p.

This report was presented to the International Conference on Ionization of the Air on October 16, 1961. It attempts to clarify the interaction of aerosols and ions and to determine what amount of ions present in the atmosphere is inhaled through a respiratory mask and actually reaches the airways. Measurements were made of the ions of various mobilities as they passed from a mixing chamber into a respiratory mask. Results of these studies indicate that it is possible to set up standardized conditions in which 20,000 small ions and 50,000 medium and large sized ions reach the mouth of the subject. This is considered the first and most necessary step in developing an experimental attack on dose-effect relationships. (Authors' abstract, in part)

2309
Swearingen, J. J.,
C. D. Wheelwright, and J. D. Garner
AN ANALYSIS OF SITTING AREAS AND PRESSURES OF MAN. — Federal Aviation Agency. Civil Aeromedical Research Inst., Oklahoma City, Oklahoma. Report no. 62-1, Jan. 1962. 10 p.

Studies were made of sitting area on a plane rigid surface for a group of 104 male subjects. Area was found to vary with height and weight and to increase with age up to 40 years after which there is a steady decline. Means were 179.4 sq. in. for area and .92 pounds/sq. in. for average pressure. Sitting contact area was found to increase with experimentally applied force of magnitudes up to something less than body weight. Analysis of pressure distribution in the sitting area reveals that nearly half of the body weight is supported on 8% of the sitting area. This high pressure area is under or adjacent to the ischial tuberosities. Over one-third of the body weight on the sitting area is removed by the addition of a footrest, chair arms, and a slightly sloping seat back. (Authors' abstract)

2310
Welch, B. E.
ECOLOGICAL SYSTEMS.—In: Physiology of man in space, p. 309-334. Ed. by J. H. U. Brown. New York and London: Academic Press, 1963.

This chapter considers the impact of the space-cabin environment on man and the impact of man on his environment and includes atmospheric, metabolic, and waste-removal parameters as well as techniques for satisfying those requirements and the use of ground-based space cabin simulators as a tool for exploring these problem areas. The critical question of the atmospheric requirements of man in space is answered in terms of total pressure control, oxygen and carbon dioxide pressure control, temperature and relative humidity control, and microcontaminant removal.

2311
Wilks, S. S.
PRELIMINARY STUDIES ON LIGHT-INDUCED CARBON MONOXIDE IN CLOSED ENVIRONMENTS.—School of Aerospace Medicine. Aerospace Medical Division, Brooks Air Force Base, Tex. (Task no. 793002). Technical Documentary Report no. SAM-TDR-63-63, Sept. 1963. iii+6 p.

Experimental data are presented concerning the effects of solar light upon certain classes of organic substances which may be components of the sealed environment of space vehicles. Many materials such as organic plastics, pigments, insulating material, etc. will, when exposed to light in the presence of oxygen, liberate a number of toxic end products such as carbon monoxide, aldehydes, acids, and certain hydrocarbons. In a sealed environment these agents may, unless removed, reach levels toxic to human beings during a long sojourn in a sealed system. Therefore, along with products that may result from thermal and electrical activity (motors, generators, etc.), these products may constitute a considerable hazard in sealed environments. (Author's abstract)

2312
Wright, C. C.
CONTAMINANT FREEZE-OUT STUDY FOR CLOSED RESPIRATORY SYSTEMS.—AiResearch Manufacturing Co., Los Angeles, Calif. (Contract AF 33(616)-7768); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637302). Technical Documentary Report no. MRL-TDR-62-7, Feb. 1962. xiii+102 p.

An analytical feasibility study was conducted on contaminant freeze-out (water vapor and carbon dioxide) systems, which employ the endothermic conversion of liquid oxygen as a heat sink. Simple freeze-out systems, combination freeze-out and adsorption systems, and systems with auxiliary cooling were studied and compared. From the point of view of minimum weight and minimum number of components, the simple freeze-out system with water removal (dumped overboard as a vapor to a vacuum) appeared to be the best system. A desirable feature of this system is that the liquid oxygen requirements are low (about equal to the normal metabolic oxygen consumption rate). A possible undesirable feature is that the frozen-out water is not recovered. The system uses a four-channel regenerative switching heat exchanger in which cooling with freeze-out, regeneration of the effluent air, and sublimation of the frozen-out contaminants occur simultaneously. The final portion of the study consists of the preliminary design of a model version of the simple freeze-out system with water removal. Recommendations as to the amount and type of additional effort required to prove feasibility and to reduce the design approach to hardware practice are also given. (Author's abstract)

f. Kitchen and Sanitary Facilities

[General sanitary aspects under 8-f]

2313
Mattoni, R. H.,
and G. H. Sullivan
SANITATION AND PERSONAL HYGIENE DURING AEROSPACE MISSIONS. —— Spacelabs, Inc., Van Nuys, Calif. (Contract AF 33(616)-7754); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637304). Technical Documentary Report no. MRL-TDR-62-68, June 1962. v+54 p.

The purpose of this study was to determine a means of providing astronauts with facilities for performing the functions of personal hygiene and sanitation while on extended aerospace missions. Included is a definition and analysis of the sources of "dirt" arising as waste products in manned space vehicles and recommendations on how to control them. Man's sanitation and hygiene requirements are defined from both a biological and psychological standpoint. A central hygiene station that provides for whole body immersion bathing, superficial bathing, dental hygiene, shaving, nail care, and laundry is described. (Authors' abstract) (36 references)

g. Flight and Space Feeding

[Basic nutritional studies under 3-f; Emergency rations under 10-d]

2314
Akhlebinskii, K. S.,
V. P. Bychkov, I. A. Il'ina, Y. I. Kondraiev, and A. S. Ushakov
[ON THE QUESTION OF SUPPLYING A SPACE SHIP CREW WITH NUTRIENTS OF ANIMAL ORIGIN] K voprosu ob obespechenii chlenov ekipazha kosmicheskoga korablia produktami zhivotnogo proiskhozhdenia. —— Problemy kosmicheskoi biologii (Moskva), 1: 145-151. 1962. In Russian.

The daily nutritional requirement of an astronaut is estimated to be 3000 kcal. The protein fraction should constitute 14% of the requirement. The creation of a completely closed ecological system is at present regarded as unattainable. It is calculated that the maintenance of a chicken flock on board a space ship will adequately insure the protein requirement.

2315
Balakhovskii, L. I.
L. I. Karpova, and S. F. Simpura
[FOOD AND WATER REQUIREMENTS OF DOGS DURING SPACE FLIGHT] Obespechenie sobak pishchei i vodoi v usloviiakh kosmicheskogo poleta.—Problemy kosmicheskoi biologii (Moskva), 1: 345-358. 1962. In Russian, with English summary (p. 358).

An automatic feeding device was developed and programed to satisfy daily food and water requirements of animals during space flight, in accordance with findings obtained in previous laboratory experiments. A homogeneous nutrient mixture, 100 g. by weight, containing 20%-30% fats and 70%-80% proteins and carbohydrates is sufficient as daily diet for animals whose body weight is 7 kg. or less, for periods up to 20 days. The water requirement is 100-120 g. per day at 20°C. Water loss through respiration amounts to 0.8 g. per kg. of body weight per hour, with a fluctuation of 0.4-1.4 g. Gas metabolism studies revealed a daily energy requirement of 400-650 cal. Gas metabolism rates, nutritional requirements, and weights of dogs used in the experiments are tabulated.

2316
Boiko, N. N.,
V. P. Bychkov, Iu. I. Kondrat'ev, and A. S. Ushakov
[ON THE PROBLEM OF THE NUTRITIONAL VALUE OF UNICELLULAR ALGAE: A SURVEY] K voprosu o pishchevoi tsennosti odnokletochnykh vodoroslei (obzor).—Voprosy pitaniia (Moskva), 21 (5): 76-81. Sept.-Oct. 1962. In Russian, with English summary (p. 81).

The authors present a survey of the literature on unicellular algae and their cultivation and nutritional value. It is the purpose of this review to investigate the possibility of establishing closed ecological systems on board future space ships. (53 references)

2317
Briggs, M. H.
SOME NUTRITIONAL PROBLEMS OF MANNED SPACEFLIGHT.—In: Space research and technology, p. 38-40. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

One of the problems of manned spaceflight is the maintenance of a satisfactory diet which contains the essential nutrients supplied in a form suitable for consumption under low-gravity conditions. On voyages of several years, food supplies will probably have to be supplemented by algae cultured within the vessel. The supply of nutrients to the algae from solid material recovered from human excreta presents many yet unsolved problems. Recovery of water from excreta appears to be possible, especially by distillation or by ion-exchange chromatography.

2318
Chapman, H. D.
HYDROPONICS OR SOILLESS CULTURE.—In: Astronautics information, Seminar proceedings: Utilization of extraterrestrial resources (Sept. 25-26, 1962), p. 10-15. April 1, 1963.

A comparison is made of yields from hydroponics and standard argicultural methods. Advantages of soilless culture, methods of supplying nutrients, and an example listing the composition of a typical nutrient solution are given. The basic physical requirements for growing plants by hydroponics such as temperature, light etc. are listed. A list of workers doing research in algal culture is given. In an appendix concerning the food requirements of man the basic requirements for setting up a hydroponics system to support a single man are stated. The basic dietary needs of the man are given: the system will supply 610 pounds of food per year.

2319
Hanson, S. W. F.
SOME PROBLEMS OF SPACEFLIGHT FEEDING.—In: Space research and technology, p. 28-30. Ed. by G. V. E. Thompson. New York and London: Gordon and Breach Science Publishers, 1962.

Recent advances in food technology suggest answers to some of the problems of spaceflight of short or long duration. The short-term flight is essentially an extension of the latest manned aircraft situation, for which foods and systems have been developed for feeding pilots through oxygen masks. For a lunar excursion lasting several days, dehydrated foods which are light and need no refrigeration seem ideal. Moreover, the continuous accretion of water from metabolism adds to the argument for dehydrated foods, which can now be made in attractive and nutritious form, rapidly reconstitutable and even pre-cooked. The interplanetary journey lasting for months to years requires the establishment of a microcosmic plant-animal balance which is not yet feasible, and the continuous subsistence on other heavenly bodies might involve intriguing "unnatural" biological problems. (Author's abstract, modified)

2320
Miller, S. A.,
H. A. Dymsza, E. L. Wick, and S. A. Goldblith
INVESTIGATION OF COMPOUNDS OF HIGH CALORIC DENSITY.—Massachusetts Inst. of Technology, Cambridge (Contract AF 33(616)-6008); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7163, Task no. 716304). Technical Documentary Report no. MRL-TDR-62-35, May 1962. viii+72 p.

The synthesis of a high-energy nutrient in the form of a methylated fatty acid, 2, 4-dimethylheptanoic acid (2, 4-DMHA), was completed. Such a compound is of interest because of its possible use as food during extended space flights. Preliminary acute toxicity tests indicated that 2, 4-DMHA has a low order of toxicity (LD_{50}-5 g./kg.) similar to other short-chain fatty acids. To facilitate metabolic studies, synthesis of the compound labeled C^{14} was begun and techniques for quantitative identification of probable metabolic products were developed. Further studies were made of the factors influencing the caloric bioassay. A series of animal studies indicated that odd-carbon fatty acids may be partly glucogenic. In addition, 1, 3-butanediol was used for energy at approximately 6.0 cal./g. in high-fat diets. The slower growth of animals fed this compound at levels up to 20% of the diet was due to decreased food intake. Seven-month feeding tests verified the effectiveness of 1, 3-butanediol and high-fat levels for dietary use under various conditions. (Authors' abstract, in part)

2321
Reddy, R. R.,
and E. B. Zwick
METHOD OF PRESERVING FROZEN FOOD DURING AN AEROSPACE MISSION.—Spacelabs, Inc., Van Nuys, Calif. (Contract AF 33(657)-8019); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637303). Technical Documentary Report no. AMRL-TDR-63-31, April 1963. iv+31 p.

Analyses of three nonelectrical methods for maintaining frozen foods between -10° F. and +5° F. during aerospace missions of 1 to 28 days are presented. The methods considered are: (1) a heat sink, (2) active refrigeration, and (3) radiation cooling. All methods appear feasible. The heat sink method appears to be the simplest and most reliable. A design study of a heat sink system for a 3-man, 14-day mission is included. (Authors' abstract)

2322
Senter, R. J.
RESEARCH ON THE ACCEPTABILITY OF PRECOOKED DEHYDRATED FOODS DURING CONFINEMENT.—Univ. of Cincinnati, Ohio (Contract AF 33(657)-7456; issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs, (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no. 716408). Technical Documentary Report no. AMRL-TDR-63-9, Jan. 1963. iii+39 p.

The essential elements of the research involved an analysis of subjects' reactions to maintenance on a precooked-dehydrated "space rations" diet during a 28-day period of confinement. Five general dependent variables were considered, i.e., (1) physiological effects of diet, (2) psychological effects of diet, (3) effects of diet on psychomotor and perceptual performance, (4) social and group dynamic effects of diet, and (5) acceptability of diets. For purposes of control, a group of subjects receiving a diet composed of frozen, fresh, and heat-processed foods was used. The control foods were consistently judged more acceptable and more palatable than the same food substances presented in dehydrated form. Analyses of the data indicated that maintenance on the precooked-dehydrated diet produced no consistent effect on the psychological, physiological, psychomotor, or social functioning of the subjects under the conditions existing during the experimental sessions. No generalizations were made concerning the possible effects of the precooked-dehydrated diet under high stress conditions. (Author's abstract)

2323
Tiller, P. R.,
N. M. Burns, and T. D. Hanna
UTILIZATION OF SEMISOLID FOOD DIETS FOR EXTENDED AEROSPACE MISSIONS. —— Naval Air Material Center. Air Crew Equipment Lab., Philadelphia, Pa. (Problem Assignment no. CO4AE13-1). Report no. NAMC-ACEL-465, Feb. 21, 1962. [4] p.

Five men (laboratory personnel) subsisted on semisolid food diets of three different caloric values for a period of ten days while carrying out their normal duties. Because of the abrupt change from a solid and varied diet to the semisolid diet, various digestive distresses were encountered by all subjects during the first four days. The subjects apparently adjusted to the diet after this period, but registered complaints concerning the insufficient variety and monotony of the diet. All subjects exhibited a weight loss ranging from 1.75-9.25 pounds for the ten-day period. Except for a drop in total cholesterol, no significant blood or urine changes were noted between the pre- and post-determinations. (Authors' summary)

2324
Turner, W. R.
FEEDING MAN IN SPACE: ENGINEERING PROBLEMS AND PROGRESS. —— American Society of Agricultural Engineers, ASAE Paper no. 62-526, [1962]. 24 p.
Abstract in: Agricultural Eng., 43 (9): 510-511. Sept. 1962.

A system for maintaining a three-man, 14-day space flight has been designed on a laboratory scale by the Whirlpool Corporation. A feeding console including food bunkers, freezer compartment, refrigerator, oven, food dispenser units, hot and cold water units, storage areas, feeding seat, and a thermoelectric power unit are described. The oven provides a temperature of 175° F., while the refrigerated storage system provides temperatures from 0° to 40° F. The waste storage system provides for the inhibition of bacterial growth, and the system is used for wastes from cleaning food utensils and from personal hygiene. Foods are kept in cans, and liquids are served from polyethylene tubes. Cans are first opened and then fitted with a special mouthpiece from which the food is taken. A special handle squeezes the food into the mouth. A food tray holds four cans or four polyethylene tubes. After use the containers are injected with the bactericidal solution, Iodophor.

2325
Ushakov, A. S.,
and V. P. Bychkov
[NUTRITIONAL PROBLEMS UNDER SPACE FLIGHT CONDITIONS] Voprosy pitaniia v usloviiakh kosmicheskikh poletov.—Problemy kosmicheskoi biologii (Moskva), 2: 48-53. 1962. In Russian, with English summary (p. 53).
English translation in: Problems of Space Biology (U. S. Joint Pub. Research Serv., Washington, D. C., no. 18,395), 2: 51-55. March 27, 1963. (Available from Office of Technical Services, U. S. Dept. of Commerce; OTS: 63-21437)

In the space flight nutrition two principal stages are to be considered, i.e., nutrition during flights of six months or less, and nutrition during flights extending over several years. In the first case the use of lyophilized foods stored in the ship is possible, provided the water is regenerated. Food supply for prolonged flights is possible only by establishing a closed ecological system recycling the substances within the space ship. A closed ecological system may be realized by including components such as unicellular algae, zooplankton, higher plants, animals, and man.

h. Disposal and Utilization of Waste Products

[*Basic studies on ecological systems under 2-b*]

2326
Brown, D. L.,
R. W. Lindstrom, and J. D. Smith
THE RECOVERY OF WATER FROM URINE BY MEMBRANE ELECTRODIALYSIS.—Ionics, Inc., Cambridge, Mass. (Contract AF 33(657)-7710); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637304). Technical Documentary Report no. AMRL-TDR-63-30, April 1963. v+50 p.

A laboratory-scale experimental program was conducted which clearly indicated the feasibility of membrane electrodialysis for recovering potable water from urine. Since electrodialysis removes electrolytes from urine, pretreatment techniques were investigated for the removal of non-electrolytes.

These techniques were: charcoal adsorption, chemical oxidation, and enzymatic hydrolysis of urea to ammonium carbonate. A model of a urine reclamation system was built, comprised of two main processes: charcoal adsorption and electrodialysis. The system weighs 15 pounds, is less than one cubic foot in size, and has a peak power requirement of 45 watts for 8 hours operation for the daily recovery of 3000 ml. of potable water from urine. The daily energy requirement is 310 watt-hr., including 160 watt-hr. for charcoal regeneration. Excellent quality water is recovered in yields of 92%. The model has good reliability and can be readily adapted for conditions of weightlessness. (Authors' abstract)

2327
Chandler, H. W.,
E. McDonald, F. S. Pollara, and G. Walden
DESIGN AND DEVELOPMENT OF REGENERATIVE CARBON DIOXIDE SORBERS.—Isomet Corp., Palisades, New Jersey (Contract AF 33(616)-7909); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637302). Technical Documentary Report no. AMRL-TDR-62-135, Nov. 1962. iii+43 p.

The operational characteristics of the two most potentially valuable regenerable carbon dioxide sorption systems, molecular sieves and silver oxide preparations, were investigated. The 5A molecular sieve removed carbon dioxide from air containing 1 volume per cent carbon dioxide, provided that water vapor was first removed from the air. At a flow rate of 500 cc./min. of this air through a 1-inch diameter column containing 100 grams of 5A molecular sieve, the bed picked up about 3 grams of carbon dioxide before carbon dioxide was detectable in the column effluent. Under identical operating conditions, a 100-gram bed containing a silver oxide preparation picked up about 8 or 9 grams of carbon dioxide. Water vapor in the air is necessary for efficient utilization of the silver oxide. Both the 5A molecular sieve and the silver oxide preparation are regenerable, but regeneration of the silver oxide occurs at a lower temperature. (Authors' abstract)

2328
deSteiguer, D.
A STUDY OF THE EFFECTS OF LONG-TERM INGESTION OF RECOVERED WATER: ANIMAL INGESTION TRIALS.—Aerojet-General Corp., Azusa, Calif. (Contract AF 33(616)-8196); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 7164, Task no 716403), Technical Documentary Report no. AMRL-TDR-63-27, March 1963. v+22 p.

Animal trials were conducted to study the physiological effects in rats and rabbits after a 16-week ingestion of water recovered from their own urine. Vacuum distillation temperatures of 80°, 120°, and 160° F. were used for recovering water from rat urine and 160° F. was used to recover water from rabbit urine. Urine losses due to evaporation necessitated dilution of the distillate 10 fold with distilled water prior to feeding. Data analyses include animal weight, distillate consumption, urine production, clinical tests, chemical analyses, bacteriological counts and histopathological examination. Abnormal conditions due to distillate consumption were not observed. (Authors' abstract)

2329
Gazenko, O. G.,
A. A. Giurdzhian, and G. A. Zakhar'ev
[SANITARY EQUIPMENT IN A HERMETICALLY SEALED CABIN] Assenizatsionnoe ustroistvo v germeticheskoi kabine.—Problemy kosmicheskoi biologii (Moskva), 1: 328-335. 1962. In Russian, with English summary (p. 335).

Differences in the anatomy of male and female dogs required separate devices for the removal of excreta. The units were made of rubberized fabric foam and vulcanized rubber. Feces and urine were channeled into a metal container filled with activated charcoal and dry moss. In the course of the experiments it was found useful to administer laxatives to the test animals. There was no evidence of tissue irritation due to the devices. The average weight of the excreta of the dogs during the experiments did not exceed 200 g. per day. The article includes a diagram of the waste removal unit, and photographs of the dogs with waste removal units attached.

2330
Nuccio, P. P.,
C. M. Tomsic, and J. D. Zeff
WASTE DISPOSAL FOR AEROSPACE MISSIONS.—General American Transportation Corp., Miles, Ill. (Contract AF 33(616)-8203); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637305). Technical Documentary Report no. AMRL-TDR-63-4, Jan. 1963. vi+47 p.

A program to develop a 3-man, laboratory-model, waste-disposal system for a 14-day aerospace mission is described. The wastes to be disposed included human feces, and burnables such as garbage, toilet paper, sponges, unused liquid foods, and polyethylene tubes. The disposal of urine was not required. The program was divided into these two parts: (1) an experimental phase to determine the thermal properties of wastes using an experimental disposal system, and (2) the second phase to design, fabricate, and test the laboratory model. Based upon the power requirements and a mass penalty of 0.15 pound/watt, incineration with pure oxygen was found to be the best technique for the mission as described. The complete system weighed 81 pounds and occupied 3.1 cubic feet. It was determined that a complete incineration cycle requires 2.6 kilowatt-hours of electrical energy and 1/2 pound of oxygen, over a 12-hour period. (Authors' abstract, in part)

2331
Poole, H. G.
LUNAR ROCKS AS A SOURCE OF OXYGEN.—In: Astronautics Information, p. 21-25. Jet Propulsion Laboratory Seminar Proceedings, April 1, 1963.

A discussion is presented of the possibility of extracting oxygen from lunar rocks. This would be possible if these rocks are similar in composition to those on Earth; that is, containing oxides of silica, aluminium, magnesium, or related compounds. These oxides would also have to be preserved under the lunar conditions of low atmospheric pressure and high temperature. If these materials are present it is thought that it would be feasible to mine and extract the material. The thermal stabilities of these oxides are given in graph form.

2332
Quon, J. E.,
and W. O. Pipes
VOLATILITY OF HUMAN WASTE AT ELEVATED TEMPERATURES.—Northwestern Univ. Technological Inst., Evanston, Ill. (Contract AF 41(657)-383); issued by Arctic Aeromedical Lab., Fort Wainwright, Alaska (Project no. 8246-01). Technical Documentary Report no. AAL-TDR-62-47, April 1963. iv+18 p.

A study was undertaken to provide information upon which a more rational approach to the design of incinerators for human waste can be based. The volatile matter and carbon remaining as a function of time were determined for different operating conditions of the volatilization chamber. An equation is proposed to describe the volatilization process, and the dependence of the constants in the volatility equation upon temperature and upon the rate of air supply to the volatilization chamber was determined. Volatilization temperatures as low as 300° C. may be feasible for some incinerator designs which provide a reactor for the oxidation of the material volatilized. (Authors' abstract)

2333
Remus, G. A.,
R. B. Neveril, and J. D. Zeff
CARBON DIOXIDE REDUCTION SYSTEM.—General American Transportation Corp., Niles, Ill. (Contract AF 33(616)-8223); issued by Aerospace Medical Division. Life Support Systems Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no 6373, Task no. 637302). Technical Documentary Report no. AMRL-TDR-63-7, Jan. 1963. iii+75 p.

An automatically operated carbon dioxide reduction system was designed, fabricated, and tested. The system will reduce 0.365 pounds of carbon dioxide per hour, equivalent to a 3.2-man carbon dioxide output, and is required for providing respiratory support for man on extended space missions. The program was conducted in three phases, analysis of a reactor developed on a previous contract, experimental determination of design parameters, and fabrication and testing of an improved engineering model. Operating characteristics, feed gas compositions, recycle flow rates, reaction temperatures and pressures, and catalyst composition and configuration were established, and the effects of variations in these were determined. Recommendations are made for improving the system and for future work. (Authors' abstract)

2334
Rudek, F. P.,
and N. Belasco
RESEARCH OF ELECTROLYSIS CELL-FUEL CELL METHOD OF RECOVERING POTABLE WATER FROM URINE.—General Electric Co. Missile and Space Division, Philadelphia, Pa. (Contract AF 33(657)-7667); issued by Aerospace Medical Division. Biomedical Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio (Project no. 6373, Task no. 637304). Technical Documentary Report no. AMRL-TDR-63-32, April 1963. viii+84 p.

A program of study and applied research was conducted to determine the feasibility of combining an ion-exchange membrane electrolysis cell and an ion-exchange membrane fuel cell so that oxygen and hydrogen which are electrolyzed from human urine recombine in the fuel cell to yield potable water and power. The latter, in turn, will satisfy some of the power requirements of the electrolysis cell. The experimental laboratory systems were synthesized from latest ion-exchange membrane technology, and produced water that is both chemically and bacteriologically well within limits of the "1961 U.S. Public Health Standards for Drinking Water". The system (ELF) has high yield (98% of available water content), long operating life (37 days plus), and produces usable low-voltage electrical power. The electrolysis cell output also provides for a high-purity (to 99.5%) emergency oxygen capability. The design is basically a zero-g type, inherently providing separation of vapor and liquid. The flexibility, reliability, and over-all simplicity of the ELF system make this water recovery technique a strong contender for future space applications. (From the authors' abstract)

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Scano, A.
[THE PRINCIPAL BIOLOGICAL ASPECTS OF SPACE FLIGHT, WITH SPECIAL REFERENCE TO THE CABIN MICROCLIMATE] I principali aspetti biologici del volo spaziale, con particolare riguardo al microclima della cabina. —Rivista di medicina aeronautica e spaziale (Roma), 25 (3): 506-529. July-Sept. 1962. In Italian, with English summary (p. 524-525).

A review is presented of the experiments and theories dealing with the use of closed ecological systems for space cabins. A critical analysis is made of oxygen supply systems, elimination of carbon dioxide, elimination of water vapor and other gaseous and volatile substances produced by man or equipment (batteries, hydraulic or refrigerant fluids, etc.), recovery and elimination of excreta, maintenance of air pressure and composition, and temperature. Closed-circuit systems for regenerating respiratory gases are described in terms of their practicality, safety, and performance. For space flights lasting several days, oxygen supplies and a chemical or physical system for the removal of carbon dioxide and other noxious compounds are preferred. For flights of several weeks or months, closed cycles of chemical and chemico-physical regeneration of oxygen from expired carbon dioxide and recovery are preferable. Closed bioregenerating systems require further study.

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